LEARNING OUTCOMES - BASED CURRICULUM FRAMEWORK (LOCF) FOR UNDERGRADUATE PROGRAMMES

DEPARTMENT OF PHYSICS

LOYOLA COLLEGE (AUTONOMOUS)
CHENNAI 600 034

PREFACE

Physics is the branch of science studying matter and energy to comprehend the laws of nature which attempts to explain the way Nature works. At college level, it provides the base for a deeper understanding of nature and enable students to follow new developments not only in basic science but also in applied technology. It encompasses, theoretical as well as practical knowledge about the principles behind every physical process. Physics explains everything around us in the physical world using the laws of Physics.

The curriculum for B.Sc. degree in Physics based on the Learning Outcome based Curriculum Framework (LOCF) model covers a fascinating range of fundamental topics like Mechanics, Electricity and Magnetism, Quantum Mechanics, Materials Science, Solid State Physics, Mathematical Physics and Electronics. It encapsulates interdisciplinary branches by incorporating Energy Physics, Astrophysics and Geophysics as Major Elective subjects of significance. The learning outcomes of the subject are intended to provide a deeper understanding of the principles of Physics combined with developing the required practical skills for engaging in the exploration of avenues related to Physics. The curriculum, teaching methodology and assessment methods are assigned with suitable cognitive levels as per the revised BLOOM's Taxonomy. The Outcome Based Education (OBE) methods will evaluate the expected course outcome attainment.

The LOCF curriculum for B.Sc. Physics is all about understanding physical systems and developing creative ability to produce highly motivated young scientific minds. It is designed to cater to the student's needs in view of launching their career in diverse fields. As the curriculum framed is based on the syllabus of the National level entrance examinations like Joint Admission Test for Masters (JAM) and Joint Entrance Screening Test (JEST), it will support the students to compete in competitive examinations for their post-graduation studies. The students are expected to learn the courses with passion and enjoy learning the science. They can enrich their knowledge in the field of their choice by taking up Self-Study Papers. This program gives the provision to the students to undergo an internship program during the course of the study. Students in turn can earn academic credits for the industry linked internship program. The department endeavours to impart an understanding of basic concepts of Physics and its relevance in modern technological advances by way of skills acquisition, innovation and entrepreneurship required for building their career in the appropriate fields of interest.

DECLARATION STATEMENT

This is to inform you that the student's web version of the LOCF model is prepared and it has been formatted according to the guidelines given by LOCF committee. The subject teachers have also given declaration, that the contents are correct to the best of their knowledge.

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CONTENTS

VISION AND MISSION OF THE COLLEGE

VISION

- Towards holistic formation of youth, grounded in excellence, through accompaniment to serve the humanity.

MISSION

- To provide inclusive education through an integral and holistic formative pedagogy.
- To promote skills that prepares them for the future.
- To kindle in young minds the spirit of social and environmental justice with a blend of academic excellence and empathy.
- To stimulate critical and conscientious scholarship leading to meaningful and innovative human Capital.

CORE VALUES

- Cura Personalis
- Pursuit of Excellence
- Moral Rectitude
- Social Equity
- Fostering solidarity
- Global Vision
- Spiritual Quotient

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1	**Professional Skill Development** To provide professional training and skill development to students in physical sciences, related disciplines and nurture them to become responsible persons in the society.
PEO 2	**Core Competency Development** To augment their core-competencies and knowledge levels in science, humanities and inter-disciplinary areas by imparting education of high standards and advanced technological tools.
PEO 3	**Innovative Curriculum of Global Relevance** To upgrade the curriculum periodically based on scientific advancements, innovations and societal relevance, so as to cater to the shifting global demands.
PEO 4	**Environmental Sensitivity and Sustainability** To infuse environmental sensitivity in students through academic activities and hence equip them with technical skills and scientific knowledge required to protect and safeguard the environment for a sustainable future.
PEO 5	**Ethical Principles and Holistic Development** To promote ethical values and focus on the holistic development of students to become proficient, skilled, competent and socially responsible people.
PEO 6	**Accessibility and Academic Excellence** To provide an accessible learning environment of excellence and equal opportunity to students, enabling them to develop their creativity, critical thinking, and leadership and employability skills.

PROGRAMME OUTCOMES (POs)

PO 1	**Disciplinary and inter-disciplinary knowledge for capacity building** Students will acquire improved knowledge of the laws governing nature through classroom teaching and experimenting in the laboratories. They will develop a sense of interdisciplinary approach to identify and resolve issues through project, seminars, field work, internships and industrial visits.
PO 2	**Skills for effective and efficient communication** Students will be able to improve and enhance their communication skills such as reading, writing, listening and speaking. This will help them to express their ideas clearly and effectively and subsequently empower them to become agents of social change and hence pave the way for betterment of the society at large.
PO 3	**Sense of inquiry and problem-solving skills** Students will demonstrate the core competencies of their discipline through analytical reasoning, problem solving and research related skills, cooperation, team work, scientific reasoning and thinking that would make them emerge as entrepreneurs or administrative personnel.
PO 4	**Skills to impact society** Students will develop leadership, team spirit and other skills which will help them to identify, approach and analyze the existing societal problems with an eye to look beyond gender, age, caste, creed or nationality and work for the emancipation and empowerment of humanity.
PO 5	**Energy, Ethics and Environment** They will be able to involve themselves in framing policies and develop scientific temper to harness energy and work on alternate resources. They will be aware of the environmental issues and imbibe the spirit of ethical values in establishing a self-sustained environment for a healthy society.
PO 6	**Self-directed and lifelong learning** Through digital literacy, students will engage in self-paced and curious learning with limitless knowledge acquisition and hence develop motivation for a sustained lifelong learning capability. Students will accumulate knowledge by continuous learning and leverage the past knowledge seamlessly to solve the problems in the future.
PO 7	**National and international-priorities preferences and perspectives** Students will be able to prioritize national and global issues with an aim to build a nation and an integrated world through contributions that imbibe the spirit of multicultural competency, creative thinking, critical analysis, political awareness and the much-needed international policies.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1	Acquire scientific temper leading to critical thinking and research motivation in Physics and its allied areas.
PSO 2	Gain knowledge and the skills to measure some of the properties of solid materials and understand the underlying principles governing the dynamics of rigid bodies.
PSO 3	Appreciate the principles of optics, electricity and magnetism and their applications in daily life.
PSO 4	Design and construct electronic circuits with computer interfacing for sophisticated analysis of material behavior and properties.
PSO 5	Comprehend algebraic concepts and advanced mathematical tools involved in the interpretation of various physical properties of materials.
PSO 6	Attain the required skills to interpret the Physics behind the phenomena occurring in nature and surroundings and hence apply them to enhance our life style.
PSO 7	Develop essential logical and analytical skills to approach a problem both quantitatively and qualitatively.

B.Sc. PHYSICS Restructured CBCS curriculum with effective from June, 2019

PART	SEMESTER I	SEMESTER II	SEMESTER III	SEMESTER IV	SEMESTER V		SEMESTER VI	CREDITS
I	G. LANGUAGE (3H/3C)	G. LANGUAGE (3H/3C)	G. LANGUAGE (3H/3C)	G. LANGUAGE (3H/3C)				12
II	GENERAL ENGLISH (6H/3C)	GENERAL ENGLISH (6H/3C)	GENERAL ENGLISH (5H/3C)	GENERAL ENGLISH (5H/3C)				12
III MC	PROPERTIES OF MATTER AND ACOUSTICS (6H/6C)	MECHANICS (6H/6C)	ELECTRICITY AND MAGNETISM (6H/6C)	ELECTRONICS I (3H/3C)	QUANTUM MECHANICS AND RELATIVITY (6H/6C)	Internship for 4 weeks during Christmas Holidays	ATOMIC AND NUCLEAR PHYSICS (6H/6C)	84
	INTRODUCTION TO DIGITAL ELECTRONICS (3H/3C)	MATHEMATICAL PHYSICS I (3H/3C)	MATHEMATICAL PHYSICS II (3H/3C)		OPTICS (6H/6C)		SOLID STATE PHYSICS (6H/6C)	
	PHYSICS PRACTICAL I (3H/3C)	PHYSICS PRACTICAL II(3H/3C)	PHYSICS PRACTICAL III (3H/3C)	PHYSICS PRACTICAL IV (3H/3C)	THERMAL PHYSICS (6H/6C)		PHYSICS PRACTICAL VII (3H/3C)	
					PHYSICS PRACTICAL V (3H/3C)		PHYSICS PRACTICAL VIII (3H/3C)	
					PHYSICS PRACTICAL VI (3H/3C)			
AR/AO	PHYSICS FOR MATHEMATICS (4H/2C)	PHYSICS FOR CHEMISTRY (4H/2C)	NUMERICAL METHODS AND C++ PROGRAMMING (3H/2C) DIGITAL ELECTRONICS (3H/2C)* APPLIED ELECTRONICS (3H/2C)*	APPLIED PHYSICS (3H/2C)#				12
	PHYSICS FOR MATHEMATICS LAB (2H/1C)	PHYSICS FOR CHEMISTRY LAB (2H/1C)	NUMERICAL METHODS AND C++ PROGRAMMING LAB (2H/1C) DIGITAL ELECTRONICS LAB (2H/1C)* APPLIED ELECTRONICS LAB (2H/1C)*	APPLIED PHYSICS LAB (2H/1C)#				
				ASTRONOMY AND ASTROPHYSICS	ELECTRONICS II (6H/6C)			

				(6H/6C)				
ME				NANOSCIENCE (6H/6C)	MATERIALS SCIENCE (6H/6C)			12
				GEOPHYSICS (6H/6C)	PROBLEM SOLVING SKILLS IN PHYSICS (6H/6C)			
MS							COMPUTATIONAL PHYSICS AND WORKSHOP TECHNOLOGY (6H/5C)	5
							SKILL BASED LAB (6H/5C)	5
							INTERNSHIP (5C)	5
					MOOC/SSP			
BT/AT /NME			WORKSHOP PRACTICE AND WIRING (3H/2C)	ELECTRONIC GADGETS (3H/2C)				4
FC	FC (3H/1C)	FC (3H/2C), EVS	FC (2H/1C)					5
CCA	CC	CCA(90H/1C)						1
ORA			OR	OR (120H/2C)				2
Hr/C	**30H/ 22C**	**30H/(23+1C)**	**30H/24C**	**30H(24+2C)**	**30H/30C**		**30H/33C**	**180/159**

Note :* Allied optional papers offered in shift II, LOYOLA COLLEGE (AUTONOMOUS), CHENNAI,
#Applied Physics for Chemistry and Applied Physics for Mathematics

DEPARTMENT OF PHYSICS

(2019 - Restructured curriculum)

OVERALL COURSE STRUCTURE

Sem	Subject Code	Course Title	T/L/P	Category*	Credit	Hours
I	UTL 1101 UFR 1101 UOL 1101 UOL 1104	GENERAL TAMIL-I FRENCH FOR BEGINNERS - I HINDI PROSE – I GENERAL SANSKRIT-I	T	GL	3	3
I	UEL 1201 UEL 1202 UEL 1203	GENERAL ENGLISH- I (ADVANCED) GENERAL ENGLISH- I (INTERMEDIATE) GENERAL ENGLISH- I (BASIC)	T	GE	3	6
I	UPH 1501	PROPERTIES OF MATTER AND ACOUSTICS	T	MC	6	6
I	UPH 1502	INTRODUCTION TO DIGITAL ELECTRONICS	T	MC	3	3
I	UPH 1503	PHYSICS PRACTICAL I	L	MC	3	3
II	UTL 2101 UFR 2101 UOL 2101 UOL 2103	GENERAL TAMIL-II FRENCH FOR BEGINNERS - II HINDI PROSE -II GENERAL SANSKRIT-II	T	GL	3	3
II	UEL 2201 UEL 2202 UEL 2203	GENERAL ENGLISH- II (ADVANCED) GENERAL ENGLISH- II (INTERMEDIATE) GENERAL ENGLISH- II (BASIC)	T	GE	3	6
II	UPH 2501	MECHANICS	T	MC	6	6
II	UPH 2502	MATHEMATICAL PHYSICS I	T	MC	3	3
II	UPH 2503	PHYSICS PRACTICAL II	L	MC	3	3
III	UTL 3101 UFR 3101 UOL 3101 UOL 3102	GENERAL TAMIL-III FRENCH FOR BEGINNERS - III HINDI POETRY -III GENERAL SANSKRIT-III	T	GL	3	3
III	UEL 3201 UEL 3202 UEL 3203	GENERAL ENGLISH- III (ADVANCED) GENERAL ENGLISH- III (INTERMEDIATE) GENERAL ENGLISH- III (BASIC)	T	GE	3	5
III	UPH 3501	ELECTRICITY AND MAGNETISM	T	MC	6	6
III	UPH 3502	MATHEMATICAL PHYSICS II	T	MC	3	3
III	UPH 3503	PHYSICS PRACTICAL III	L	MC	3	3
IV	UTL 4102	GENERAL TAMIL-IV	T	GL	3	3

	UFR 4101 UOL 4101 UOL 4102	FRENCH FOR BEGINNERS - IV HINDI POETRY -IV GENERAL SANSKRIT-IV				
IV	UEL 4201 UEL 4202 UEL 4203 UEL 4204 UEL 4205 UEL 4206 UEL 4207	INTRODUCTION TO TECHNICAL TRANSLATION SOFT SKILLS FOR PROFESSIONAL DEVELOPMENT PROFESSIONAL CONTENT WRITING ENGLISH FOR TECHNICAL WRITING ENGLISH FOR EMPLOYABILITY SKILLS ESSENTIAL SKILLS FOR GROUP COMMUNICATION THEATRE PERFORMANCE AND FILM REVIEW	T	GE	3	5
IV	UPH 4501	ELECTRONICS I	T	MC	3	3
IV	UPH 4502	PHYSICS PRACTICAL IV	L	MC	3	3
IV	UPH 4601	ASTRONOMY AND ASTROPHYSICS	T	ME	6	6
IV	UPH 4602	NANOSCIENCE	T	ME	6	6
IV	UPH 4603	GEOPHYSICS	T	ME	6	6
V	UPH 5501	QUANTUM MECHANICS AND RELATIVITY	T	MC	6	6
V	UPH 5502	THERMAL PHYSICS	T	MC	6	6
V	UPH 5503	OPTICS	T	MC	6	6
V	UPH 5504	PHYSICS PRACTICAL V	L	MC	3	3
V	UPH 5505	PHYSICS PRACTICAL VI	L	MC	3	3
V	UPH 5601	ELECTRONICS II	T	ME	6	6
V	UPH 5602	MATERIAL SCIENCE	T	ME	6	6
V	UPH 5603	PROBLEM SOLVING SKILLS IN PHYSICS	T	ME	6	6
VI	UPH 6501	SOLID STATE PHYSICS	T	MC	6	6
VI	UPH 6502	ATOMIC AND NUCLEAR PHYSICS	T	MC	6	6
VI	UPH 6503	PHYSICS PRACTICAL VII	L	MC	3	3
VI	UPH 6504	PHYSICS PRACTICAL VIII	L	MC	3	3
VI	UPH 6701	COMPUTATIONAL PHYSICS AND WORKSHOP TECHNOLOGY	T	MS	5	6
VI	UPH 6705	INTERNSHIP	I	MS	5	
VI	UPH 6706	SKILL BASED LAB	L	MS	5	6

OFFERED TO OTHER DEPARMENTS

Sem	Subject Code	Course Title	T/L/P	Category*	Credit	Hours
I	UPH 1301	PHYSICS FOR MATHEMATICS	T	AR	2	4
I	UPH 1302	PHYSICS FOR MATHEMATICS LAB	L	AR	1	2
II	UPH 2301	PHYSICS FOR CHEMISTRY	T	AR	2	4
II	UPH 2302	PHYSICS FOR CHEMISTRY LAB	L	AR	1	2
III	UPH 3401	NUMERICAL METHODS AND C++ PROGRAMMING	T	AO	2	3
III	UPH 3402	NUMERICAL METHODS AND C++ PROGRAMMING LAB	L	AO	1	2
III	UPH 3403	APPLIED ELECTRONICS	T	AO	2	3
III	UPH 3404	APPLIED ELECTRONICS LAB	L	AO	1	2
III	UPH 3405	DIGITAL ELECTRONICS	T	AO	2	3
III	UPH 3406	DIGITAL ELECTRONICS LAB	L	AO	1	2
III	UPH 3801	WORKSHOP PRACTICE AND WIRING	T	NME	2	3
IV	UPH 4401	APPLIED PHYSICS	T	AO	2	4
IV	UPH 4402	APPLIED PHYSICS LAB	L	AO	1	2
IV	UPH 4801	ELECTRONIC GADGETS	T	NME	2	3

COURSE DESCRIPTORS

Course Code	UPH 1501
Course Title	PROPERTIES OF MATTER AND ACOUSTICS
Credits	06
Hours/Week	06
Category	Major Core (MC) – Theory
Semester	I
Regulation	2019

Course Overview

1. This course focuses on fundamental Physics phenomena existing in nature.
2. It helps the learners to understand the elastic properties of materials used in our day today life.
3. It envisages the Physics behind the characteristics of liquids.
4. This course teaches the basics of harmonic motion and periodic motion and their characteristics. It will let learners understand the periodic motions in Nature.
5. It explains the characteristics of sound and its propagation in different media. This course will enable the learners to design a good acoustical auditorium.

Course Objectives

1. To teach the elastic properties of materials and their use in various fields and its application in manufacturing technology.
2. To evaluate the basic properties of liquids like surface tension and viscosity.
3. To acquire knowledge about harmonic motion and its characteristics.
4. To establish the mathematical formulation of wave motion and to study the relative motion between the wave and the observer are also learnt from this course.
5. To learn the basic characteristics of sound and its application in various fields.

Prerequisites	Fundamental knowledge in Physics and Chemistry

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**ELASTICITY** Hooke's Law – Stress–Strain diagram – Moduli of Elasticity – Poisson's ratio - Relation between elastic constants and Poisson's ratio - Work done in stretching a wire – Twisting couple on a cylinder – Torsional pendulum (with and without weights) - Bending of beams – Bending moment – Cantilever loading – Expression for depression at the loaded end - Oscillations of a cantilever - Young's Modulus – Non–uniform and uniform bending - Koenig's method - Moduli of Elasticity and Relation between elastic constants	18		
II	**VISCOSITY** Streamline and turbulent motion – Newton's law – Poiseuille's flow - Terminal velocity and Stokes' formula – Ostwald viscometer - Meyer's modification of Poiseuille's	18		

	formula - Rankine's method - Effect of temperature and pressure on viscosity – Equation of continuity – Bernoulli's theorem - Venturimeter – Torricelli's theorem - Stokes' and Poiseuille's formula		CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**SURFACE TENSION** Definition – Molecular forces - Jaeger's method - Excess pressure inside a curved liquid surface – Variation of surface tension with temperature - Angle of contact – Quincke's method - Drop weight method of determining the surface tension of liquid - Interfacial surface tension – Experiment to determine the interfacial surface tension between water and liquid.	18		
IV	**WAVES AND OSCILLATIONS** Simple Harmonic Motion – Differential equation of SHM – Graphical representation of SHM -Illustration of SHM: Oscillations of a gas in a cylinder - Wave motion – Transverse and longitudinal waves - General equation of simple harmonic motion - Wave velocity and particle velocity – Differential equation of wave motion - Stationary waves – Properties of stationary waves – Doppler effect.	18		
V	**ACOUSTICS** Intensity of sound – Decibel and Bel –Loudness of sound - Reverberation – Sabine's reverberation formula - Acoustic intensity – Factors affecting the acoustics of Buildings - Ultrasonic waves – Production of ultrasonic waves - Piezo electric crystal method - Magnetostriction effect - Application of ultrasonic waves.	18		

Text Books

1. R. Murugesan, 2005, Properties of Matter, S. Chand and Co., 5th edition.
2. Brij Lal and N. Subrahmanyam, 2003, Properties of Matter, S. Chand and Co., 6th edition.
3. D.S Mathur, 2010, Elements of Properties of Matter, S. Chand and Co., 11th edition.
4. D.R. Khanna and R.S. Bedi, 1969, Textbook of Sound, Atmaram and sons., 7th edition.
5. R. Murugesan, 2003, A textbook of Sound, S. Chand and Co., 11th edition.

Suggested Readings

1. H.R Gulati, 1977, Fundamental of General Properties of Matter, R Chand and Co., 5th edition.
2. N.K Bajaj, 1988, The Physics of Waves and Oscillations, Tata McGraw Hill, 20th edition.
3. A.P French, 2003, Vibration and Waves, MIT Introductory Physics, Arnold–Heinmann India, 1st edition.
4. SatyaPrakash and Akash Saluja, 2002, Oscillations and Waves, Pragati Prakashan, 8th edition.

Web Resources

1. https://rb.gy/jdfymw
2. https://www.generationgenius.com/properties-of-matter-for-kids/
3. https://rb.gy/f6usb3
4. https://Physics.info/elasticity/
5. https://www.nasa.gov/specials/X59/science-of-sound.html

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	Understand and interpret the elastic nature of the materials.	K1, K2
CO 2	Identify the most and least viscous fluids.	K3
CO 3	Real life experiences of Surface tension, Capillarity of liquids and wave motion.	K4
CO 4	Analyze waves and oscillations.	K5
CO 5	Design and operate acoustic systems.	K6

Course Code	UPH 1502
Course Title	INTRODUCTION TO DIGITAL ELECTRONICS
Credits	03
Hours/Week	03
Category	Major Core (MC) – Theory
Semester	I
Regulation	2019

Course Overview

1. Digital Electronics course is designed to give an understanding of the working of basic and universal gates, which in turn helps to develop complicated circuits. It also gives complete idea of Boolean laws, theorems and simplification of logic circuits and expressions using them.
2. Different number systems are discussed and conversion from one number system to another is also explained.
3. The working principle and uses of encoders, decoders, multiplexers and demultiplexers are discussed.
4. Arithmetic circuits and its working are analyzed in detail.
5. The working of flip-flops and their uses in constructing digital devices are discussed.

Course Objectives

1. To understand the working of logic gates and to use Boolean equations and Karnaugh maps to simplify and check the output of logic circuits.
2. To know the uses of encoders, decoders, multiplexers and demultiplexers.
3. To learn different numbers systems and their conversion from one to another.
4. To understand the working of arithmetic circuits.
5. To understand the working of flip-flops and to analyze sequential circuits.

Prerequisites	Basic knowledge on binary number system and logic gates.

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**DIGITAL LOGIC AND LOGIC CIRCUITS** Basic gates – NOT, OR, AND – EX-OR gates – Universal logic gates – NOR, NAND – Positive and Negative logics. Boolean laws and theorems – Sum-of-Products method – Truth table to Karnaugh map – Pairs, Quads, and Octets – Karnaugh simplifications – Don't- care conditions.	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**DATA PROCESSING CIRCUITS** Multiplexer – 4 to 1 multiplexer – Demultiplexer – 1 to 4 demultiplexer – Decoder – 2 to 4 decoder – BCD to seven segment decoder – Encoders – Decimal to BCD encoder.	9		

III	**NUMBER SYSTEMS AND CODES** Binary number system – Binary to decimal conversion – Decimal to binary conversion – Octal numbers – Conversion of octal numbers – Hexadecimal numbers – Conversion of hexadecimal numbers – The ASCII code – The Gray code.	9		
IV	**ARITHMETIC CIRCUITS** Binary addition – Binary subtraction – Unsigned binary numbers – Sign – Magnitude numbers – 2's complement representation – 2's complement arithmetic – Half adder – Full adder – Controlled inverter.	9		
V	**FLIP – FLOPS** RS flip-flops – Gated flip-flops – Edge-triggered RS flip-flops – Edge-triggered D flip-flops – JK flip-flops – T flip-flops.	9		

Text Books

1. Donald P Leach, Albert Paul Malvino, Goutam Saha, 2011, Digital Principles and Applications, Tata McGraw – Hill Publishing Company Limited, 7th Edition.

Suggested Readings

1. James W. Bignel, 2007, Digital Electronics, Cengage learnings, 5th edition.
2. M. Morris Mano, Michael D. Ciletti, 2013, Digital design with an introduction to the VHDL, Pearson Education, 5th edition.
3. S K Mandal, 2017, Digital Electronics Principles & Applications, McGraw Hill Education. 1st edition.
4. William Keitz, 2013, Digital Electronics – A practical approach with VHDL, Pearson Education, 9th edition.
5. Thomas L. Floyd, 2015, Digital Fundamentals, Pearson Education, 11th edition.
6. D.P. Kothari, J.S. Dhillon, 2016, Digital Circuits and Design, Pearson Education, 1st edition.

Web Resources

1. https://circuitglobe.com/rs-flip-flop.html
2. http://hyperPhysics.phy-astr.gsu.edu/hbase/Electronic/jkflipflop.html
3. https://circuitglobe.com/half-adder-and-full-adder-circuit.html
4. https://programmerbay.com/construct-4-to-1-multiplexer-using-logic-gates/
5. https://www.electronicshub.org/demultiplexerdemux/
6. https://www.elprocus.com/designing-of-2-to-4-line-decoder/
7. https://www.electricaltechnology.org/2018/05/bcd-to-7-segment-display-decoder.html

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	To classify and convert one number system to other number systems and to select the most suitable one for specific application.	K1, K2
CO 2	To write Boolean equations for logic circuits and thereby develop equivalent circuits.	K3
CO 3	To analyze sequential circuits.	K4
CO 4	To comprehend different arithmetic and logic functions with appropriate selection of inputs and check the possible outputs for arithmetic and logic circuits.	K5
CO 5	To design logic circuits for simplified Boolean expressions.	K6

Course Code	UPH 1503
Course Title	PHYSICS PRACTICAL – I
Credits	03
Hours/Week	03
Category	Major Core (MC) – Practical
Semester	I
Regulation	2019

Course Overview

1. The course emphasises the need to have hands–on-experience on the measurement of physical quantities and understand the theoretical concepts through practical means.
2. It aims to help in estimating physical properties such as the elastic, mechanical, electric and optical properties of different materials using scientific instruments.
3. The basics of Boolean Algebra and their concepts are discussed in detail.

Course Objectives

1. Measurement of surface tension, viscosity and heat capacity of liquids.
2. Modulus of elasticity measurement by dynamic methods.
3. Verify the three laws of transverse vibrations in stretched strings.
4. Construct a plano-convex lens using solid-liquid interface and hence find refractive index of a liquid.
5. Construction of basic gates using discrete components.
6. Calibrate low range ammeter using potentiometer.

Prerequisites	Basic knowledge on usage of scientific apparatus.

SYLLABUS

S.No	List of experiments	Hours per week	COs	Cognitive levels
1	Capillary rise – determination of surface tension of liquid.	3	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
2	Rigidity modulus of the material of the wire – Torsional pendulum (with weights).			
3	Viscosity of liquid – Capillary flow using graduated burette.			
4	Specific heat capacity of a liquid – Newton's law of cooling.			
5	Sonometer – Verification of laws of transverse vibrations in a stretched string.			

6	Liquid lens – determination of refractive index of a liquid.			
7	Logic gates – verification of truth table for OR, AND &NOT using discrete components.			
8	Potentiometer – Calibration of low range ammeter.			

Suggested Readings

1. S.P. Singh, 1999, Advanced Practical Physics with Viva – voce II, Pragati Prakashan – Meerut Burke, 23rd edition.
2. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan –Meerut Burke, 23rd edition.
3. M. Nelkon & J.M. Ogborn, 1967, Advanced level Practical Physics, Heinemann Educational Books. Ltd – London, 3rd edition.
4. M. Nelkon & J.M. Ogborn, 1941, A Textbook of Practical Physics, Macmillan and Co & Limited, 4th edition.
5. Indu Prakash & Ramakrishna, 2011, A Text Book of Practical Physics, Kitab Mahal, 3rd edition.
6. Nelkon and Ogborn, 1978, Advanced level Practical Physics, Heinemann Edu. Publ., 4th edition.
7. D. Chattopadhyay & P. C Rakshit, 2011, An Advanced Course in Practical Physics, New Central Book Agency, 10th edition.
8. G.L. Squires, 2012, Practical Physics, Cambridge University Press, 4th edition.

Web Resources

1. https://vlab.amrita.edu/?sub=1&brch=280&sim=1518&cnt=4
2. https://rb.gy/9e5mrd
3. https://rb.gy/m7aiog
4. http://htv – au.vlabs.ac.in/heat _ thermodynamics/Newtons_Law_of_Cooling/experiment.html
5. https://rb.gy/isiyfm
6. https://rb.gy/ysfsgv

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Levels
CO 1	Define the aim of the experiment and explain the various parameters in the formula that is used to estimate the physical property of a material. Identify the equipment and get the accessories.	K1, K2
CO 2	Arrange and assemble the gadgets and carryout the experiment.	K3
CO 3	List the observations and repeat the experiment to find the average and hence determine the physical quantity by making use of the required formula.	K4
CO 4	Interpret and report the result and classify the materials based on the measurement (or) verify a given law. Sketch the variations wherever required.	K5
CO 5	Analyze the results of the experiment with an aim to construct or design an equipment or a device for use in project work/research work.	K6

Course Code	UPH 1301
Course Title	PHYSICS FOR MATHEMATICS
Credits	03
Hours/Week	04
Category	Allied Required (AR) – Theory
Semester	I
Regulation	2019

Course Overview

1. This course deals with the learning of the theoretical concepts of Physics in general along with their practical applications.
2. The course aims to train the students in basic knowledge of Physics, and understand the laws governing them.
3. Mechanics, Gravitation, Properties of Matter, Electronics, Special theory of relativity are the different topics to be discussed in the course.
4. The students will develop the knowledge on the laws and principles in Physics.
5. The major focus will be on Simple Harmonic motion, Operational amplifiers, Michelson interferometer, etc.,

Course Objectives

1. To understand the fundamentals of Physics.
2. To understand the use of laws of Physics in daily lives.
3. To understand the fundamental of Electronics and their applications.
4. To apply the mathematical tools in understanding Physics.
5. To convert theoretical knowledge into practical use.

Prerequisites	Basic knowledge on Physics and Mathematics

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**MECHANICS** Distance and Displacement, velocity and acceleration – distance-time graph – velocity-time graph – motion in a plane – projectile motion – angular displacement, angular velocity, angular acceleration – uniform circular motion – centripetal and centrifugal force – oscillation of spring mass system – potential and kinetic energy variations – simple pendulum.	10	CO1, CO2, CO3, CO4, CO5	K1,K2,K3,K4,K5,K6
II	**GRAVITATION** Kepler's laws – deduction of Newton's law of gravitation from Kepler's law – Newton's law of gravitation – experimental determination of gravitational	12		

	constant – Boy's method – Gravitational field strength – Parking orbit – density of the earth – mass of the earth and Sun –gravitational potential – velocity of escape – potential and kinetic energies of a satellite.			
III	**PROPERTIES OF MATTER** Elasticity – Hooke's law – different moduli of elasticity- Poisson's ratio – energy stored in a wire – relation between the elastic moduli – torsion in a wire. Viscosity and surface tension: coefficient of viscosity– Poiseuille's formula for the flow of liquid through a capillary tube – variation of viscosity with temperature and pressure – excess pressure inside a curved liquid surface – spherical and cylindrical drops – Drop weight method of determining the surface tension of a liquid – interfacial Surface tension.	15		
IV	**ELECTRONICS** Semiconductors– intrinsic and extrinsic semiconductor – pn junction diode – forward and reverse bias of a junction diode – V-I characteristics of a junction diode – LED – Zener diode – AND, OR, NOT gates – construction using diodes and transistors – NAND and NOR gates – Universal building blocks	10		
V	**SPECIAL THEORY OF RELATIVITY** Frames of reference – inertial frames and non-inertial frames – Galilean transformations – Michelson Morley experiment – interpretation of results – postulates of special theory of relativity – Lorentz transformation equations(no derivation) – length contraction – time dilation – Mass-energy equation.	12		

Text Books

1. R. Murugeshan, Allied Physics, 2010, S. Chand and Co. 3rd edition.
2. D.S. Mathur, 2012, Mechanics S. Chand and Co., 1st edition.
3. H.C. Verma, 2017, Concepts of Physics (vol 1 & 2) Bharati Bhawan, 1st edition.
4. R.S. Sedha and M. N. Avadhanulu, 1998, A Text book of applied electronics, 25th edition, S. Chand and Co. 1st edition.
5. V. Vijayendran, 2011, Integrated electronics S. Viswanathan printers and publishers Pvt. Ltd., 1st edition.

Suggested Readings

1. D. Halliday and R. Resnick, 2013, Fundamentals of Physics, Wiley eastern,10th edition.
2. Richard P. Feynman, Robert B. Leighton & Mathew Sands, 2006, Feynman lectures on Physics series, vol. 1, 2 & 3, Narosa publishing Ltd., The new millennium edition.

Web Resources

1. https://ncert.nic.in/ncerts/l/leph201.pdf
2. https://books.google.co.in/
3. https://rb.gy/orlmk8
4. https://www.analog.com/
5. http://www.ee.surrey.ac.uk/

6. https://digitalcommons.unl.edu/
7. https://www.khanacademy.org/
8. https://open.umn.edu

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	Apply simple concepts of mechanics in daily life.	K1, K2
CO 2	Explain how Kepler's laws are used in the development of Newton's law of universal gravitation.	K3
CO 3	Explore the elastic nature of different materials.	K4
CO 4	Design simple electronic circuits.	K5
CO 5	Explain the mechanics of objects moving at relativistic speed the concepts in special theory of relativity.	K6

Course Code	UPH 1302
Course Title	PHYSICS FOR MATHEMATICS PRACTICAL
Credits	01
Hours/Week	02
Category	Allied Required (AR) – Practical
Semester	I
Regulation	2019

Course Overview

1. The course aims to provide endorses the complete requirements and expectations of the students to acquire practical knowledge in basic Physics through simple Physics.
2. Purpose of this course is to help students in assessing the physical properties of rigid bodies, and sound properties of the materials using scientific instruments.
3. Students will be able to estimate the properties of liquids through simple experiments.
4. They will be introduced to fundamental logic gates like AND, OR, NOT etc.

Course Objectives

1. Modulus of elasticity measurement by stretching.
2. Measurement of surface tension & viscosity of liquids.
3. Verifying the three laws of transverse vibrations in stretched strings.
4. Calculating the acceleration due to gravity "g" and radius of gyration "k" by oscillation method.
5. Construction of basic gates using discrete components.
6. Measuring the interfacial surface tension using method of drops.

Prerequisites	Basic knowledge on usage of scientific apparatus.

SYLLABUS

S.No	List of experiments	Hours per week	COs	Cognitive levels
1	Young's modulus by stretching – Vernier microscope.	2	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
2	Rigidity modulus – torsional pendulum			
3	Surface tension and interfacial tension – method of drops.			
4	Viscosity – capillary flow.			
5	Sonometer –Verification of laws			
6	Compound bar pendulum – determination of 'g' and radius of			

	gyration (k).			
7	Basic Gates using ICs – AND, OR,NOT & NAND.			
8	NAND & NOR as Universal building blocks			

Text Books

1. Anchal Srinivasa & R.K. Shukla, 2018, Practical Physics, New age International Publishers, 2nd edition.
2. C.C. Ouseph & V. Srinivasan, 1990, A text book of Physics Practical – Part I, S. ViswanathanPublishers, 1st edition.
3. C.C. Ouseph & G. RangaRajan, 1996, A text book of Physics Practical – Part II, S.Viswanathan Publishers, 1st edition.
4. S.P. Singh, 2000, Advanced Practical Physics II, Pragati Prakashan – Meerut, 12th edition.
5. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan – Meerut, 23rd edition.

Suggested Readings

1. S.P. Singh, 1999, Advanced Practical Physics with Viva – voce II, Pragati Prakashan – Meerut Burke, 23rd edition.
2. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan – Meerut Burke, 23rd edition.
3. M. Nelkon & J.M. Ogborn, 1967, Advanced level Practical Physics, Heinemann Educational Books. Ltd-London, 3rd edition.
4. M. Nelkon & J.M. Ogborn, 1941, A textbook of Practical Physics, Macmillan and Co & Limited, 4th edition.
5. Indu Prakash & Ramakrishna (Kitab Mahal), 2011, A Text Book of Practical Physics, 3rd edition.
6. Nelkon and Ogborn, 1978, Advanced level Practical Physics, Heinemann Edu. Publ., 4th edition.
7. D. Chattopadhyay& P. C Rakshit, 2011, An Advanced Course in Practical Physics, New Central Book Agency, 10th edition.
8. G.L. Squires, 2012, Practical Physics, Cambridge University Press, 4th edition.

Web Resources

1. https://www.youtube.com/watch?v=8dZxWOTMRwA
2. https://rb.gy/jp3h01
3. https://www.youtube.com/watch?v=kjMfwS857Uw
4. https://rb.gy/e1lzux
5. https://www.youtube.com/watch?v=2vk0F7bwBzw
6. https://rb.gy/zzdvdd
7. https://www.youtube.com/watch?v=gnhotr13e6U

Course Outcomes (COs) and Cognitive Level Mapping

Cos	CO Description	Cognitive Levels
CO1	Determine the rigidity modulus and Young's modulus of a given wire.	K1, K2
CO2	Employ method of drops to calculate the surface tension of a given liquid.	K3
CO3	Evaluate the viscosity of the given liquid by capillary flow method.	K4
CO4	Verify the laws of transverse vibrations in a stretched string using Sonometer.	K5
CO5	Demonstrate NAND & NOR as Universal Building blocks.	K6

Course Code	UPH 2501
Course Title	MECHANICS
Credits	06
Hours/Week	06
Category	Major Core (MC) – Theory
Semester	II
Regulation	2019

Course Overview

1. Mechanics is the foundation on which the entire structure of Physics is built up. The aim of the course is to expose students to a different approach to learning Physics based on strong conceptual understanding of the fundamental laws governing the motion of bodies in the macroscopic world.
2. Conservation laws are introduced and their utility in understanding the behaviour of physical systems is intended to be lucidly brought out.
3. The mathematical model of harmonic oscillations and the different techniques of solving the differential equation is introduced to illustrate the availability of different methods to tackle any Physics problem.
4. Through parallel and perpendicular axes theorems in rigid body dynamics, the students get to appreciate the motion of rigid bodies about any fixed point and any arbitrary axis passing through this point.
5. Special theory of relativity gives a glimpse of the relativistic realm. Transformation equations are derived to correlate observations from different inertial frames. Some consequences of tremendous speed are brought out.

Course Objectives

1. To lay a strong conceptual foundation in Mechanics leading to independent thinking and problem solving.
2. To enable the students to understand and apply the conservation laws in Physics.
3. To introduce mathematical modelling of physical phenomena using simple harmonic motion as an example.
4. To make the students understand rigid body dynamics and compare the motion of rigid bodies around different fixed points.
5. To give an introduction to special theory of relativity.

Prerequisites	1. Understanding of the basic laws of Physics. 2. Fundamental knowledge of calculus.

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVELS
I	**NEWTON'S LAWS OF MOTION** Newton's laws of motion - Forces and equations of motion - Motion of a particle in a uniform gravitational field - Newtonian law of universal gravitation – Examples - Electric and magnetic forces on a charged particle -The magnetic field and Lorentz force Examples - Motion of charged particle in a uniform electric and magnetic field -	20		

	Conservation of momentum - Contact forces: friction – Problems.			
II	**CONSERVATION LAWS** Definition of concepts - Conservation of energy - Work – Kinetic and potential energies Examples - Conservative forces - Potential energy and conservation of energy in gravitational and electric field Examples - Conservation of linear and angular momenta - Internal forces and momentum conservation - Centre of mass – Examples - General elastic collision of particles of different masses - Conservation of angular momentum Torque due to internal forces Torque due to gravity - Angular momentum about centre of mass Proton scattering by heavy nucleus.	20	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**HARMONIC OSCILLATOR** Mass on a spring - Simple pendulum (Force, energy and torque methods) - Compound pendulum - LC circuit - Average kinetic energy and potential energy. Friction – Damped harmonic oscillator.	15		
IV	**ELEMENTARY RIGID BODY DYNAMICS** The equation of motion – Angular momentum and kinetic energy – Moment of inertia – parallel axes theorem – perpendicular axes theorem – examples – Rotation about fixed axis: time dependence of motion – Examples - Rolling without slipping (three methods) – Torque about centre of mass – Examples.	15		
V	**SPECIAL RELATIVITY** Constancy of speed of light – Michelson – Morley experiment – Invariance of c - Basic assumptions – Lorentz transformation – Length contraction – Time dilation of moving clocks – examples – Velocity transformation example (velocity addition).	20		

Text Books

1. Charles Kittel, Walter D Knight etc, Mechanics (in SI units) - (Berkley Physics course-volume 1), 2017, Tata McGraw Hill publication, 2nd edition.

Suggested Readings

1. A.P. French, 2017, Newtonian mechanics by, Viva Books Private Ltd., 1st edition.
2. Kleppner and Kolenkow, 2010, Introduction to mechanics, McGraw Hill Publishers (Special Indian edition), 1st edition.

Web Resources

1. NPTEL :: Basic courses-Sem 1 and 2 - Classical Physics
2. The Feynman Lectures on Physics Vol. I Ch. 10: Conservation of Momentum (caltech.edu)
3. Conservation of energy (video) | Khan Academy
4. NPTEL :: Physics - NOC:Waves and Oscillations
5. NPTEL :: Mechanical Engineering - Dynamics of Machines
6. NPTEL :: Physics - Special Theory of Relativity

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	Use the foundational principles of mechanics such as rigid body dynamics, harmonic oscillations, conservation laws and special theory of relativity.	K1, K2
CO 2	Apply conservation laws to predict the trajectory of bodies undergoing collision and moving under the influence of a conservative force field, use Lorentz transformation equations to determine the effects of high speed.	K3
CO 3	Differentiate the parameters of rotational motion from that of linear motion analyze scattering problems using conservation laws and demonstrate that diverse treatments lead to the same final result. Calculate the relativistic changes in length, time and velocity.	K4
CO 4	Estimate the moment of inertia of rigid bodies and frequencies of oscillating systems with a linear response to a deforming force.	K5
CO 5	Derive Lorentz transformation equations and bring out the counter-intuitive features of special theory of relativity.	K6

Course Code	UPH 2502
Course Title	MATHEMATICAL PHYSICS – I
Credits	03
Hours/Week	03
Category	Major Core (MC) – Theory
Semester	II
Regulation	2019

Course Overview

1. Mathematical Physics is one of the inseparable parts of undergraduate Physics course. The various mathematical techniques are very much required to explain natural phenomena quantitatively. Complex analysis plays vital role in explaining wave phenomena, quantum systems etc. In this unit, the basic structure of complex algebra is introduced in a systematic way.
2. The Calculus of real variable is extended to complex variables and various interesting results are discussed.
3. Vector algebra is introduced with the intention of studying the properties of scalar and vector functions.
4. The course aims to introduce Vector calculus and discuss in detail the divergence, curl and gradient
5. A brief introduction to Fourier analysis and the concept of Fourier series as they play a vital role in various branches of science.

Course Objectives

1. To introduce clear foundation of basics of complex algebra.
2. To enable the students to understand and appreciate the properties of complex variable.
3. To introduce the basic properties of vectors and enable the students to apply in physical situations.
4. To make the students understand and apply the grad, div and curl functions in physical situations.
5. To give a good introduction on Fourier series and make the students to apply Fourier series concept into well-known periodic functions.

Prerequisites	1. Basic knowledge of integration and differentiation. 2. Fundamentals of school level Physics.

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**COMPLEX FUNCTIONS** Complex numbers – Complex plane – Complex functions – Analytic function – Cauchy – Riemann equations – Laplace's equation – Harmonic functions – Exponential,	9		

	trigonometric and hyperbolic, logarithmic functions and their properties.		CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**COMPLEX INTEGRATION** Line integral and its basic properties – Evaluation of line integral by indefinite integration – Cauchy's integral theorem – Cauchy's integral formula.	9		
III	**VECTOR ALGEBRA** Rectangular resolution of a vector – Position vector of a point – Scalar and vector products – Moment of a force – Angular velocity – Scalar triple product – Geometrical interpretation – Vector triple product.	9		
IV	**VECTOR CALCULUS** Vector and scalar functions – Differentiation of vector and scalar functions – Gradient of a scalar function – Geometrical meaning of gradient – Directional derivative – Divergence and curl of vector functions – Physical interpretation of divergence and curl.	9		
V	**FOURIER SERIES** Periodic functions – Dirichlet conditions for a Fourier series – Fourier series for rectangular wave – Functions of any period: Periodic square wave and half–wave rectifier – Even and odd functions: Rectangular and saw tooth waves.	9		

Text Books

1. Erwin Kreyzig, 1991, Advanced Engineering Mathematics, Wiley Eastern Ltd, 8th edition.
2. H. K. Dass, 2010, Mathematical Physics, , S. Chand Publishing, 1st edition.

Suggested Readings

1. George Arfken, Hans Weber, 2003, Mathematical methods for Physicists, Academic Press, 6th edition.
2. V. Balakrishnan, 2019, Mathematical Physics with Applications, Problems and solutions, ANE books, 1st edition.
3. Mary L. Boas, 2006, Mathematical methods in Physical Sciences, Wiley, 3rd edition.
4. Riley & Hobson, 2011, Mathematical methods for Physical Sciences, Cambridge University Press, 3rd edition.

Web Resources

1. https://rb.gy/fcubkc
2. https://www.youtube.com/watch?v=SP-YJe7Vldo
3. https://www.youtube.com/watch?v=UKHBWzoOKsY
4. https://www.youtube.com/watch?v=AIxiYG-gZ00&list=PLHXZ9OQGMqxfW0GMqeUE1bLKaYor6kbHa
5. https://rb.gy/p1cvpq

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	Use real and complex analysis in solving problems in physics.	K1, K2
CO 2	Apply the Cauchy integral theorem and formula to evaluate real integrals	K3
CO 3	Understand the role of vectors in Physics	K4
CO 4	Apply the concepts Curl and Divergence in solving physics problems.	K5
CO 5	Analyze a periodic function and obtain its Fourier components	K6

Course Code	UPH 2503
Course Title	PHYSICS PRACTICAL – II
Credits	03
Hours/Week	03
Category	Major Core (MC) – Practical
Semester	II
Regulation	2019

Course Overview

1. The aim of this course is to provide a basic knowledge in measuring different physical quantities.
2. This course aims to help in estimating the various physical properties such as the elastic, mechanical, electric & magnetic and optical properties of different materials using scientific apparatus.
3. It provides an opportunity to study the universal gates using IC's.

Course Objectives

1. To determine the value of acceleration due to gravity at a given place.
2. To Measure the elastic property such as Young's modulus of a material.
3. To determine the refractive index of a solid prism using spectrometer.
4. To determine the magnetic moment of a bar magnet using deflection magnetometer.
5. To explore the fundamental digital concept by establishing NAND and NOR gates as Universal building blocks.

Prerequisites	Basic knowledge on usage of scientific apparatus

SYLLABUS

S.No	List of experiments	Hours Per week	COs	Cognitive levels
1	Compound bar pendulum – determination of acceleration due togravity and geometrical moment of inertia.	3	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
2	Young's modulus of a material using cantilever – pin and microscope.			
3	Air wedge – Determination of thickness of insulation of a wire.			
4	Deflection magnetometer – Tan C position – determination of magnetic Moment of a bar magnet.			
5	Carey-Foster's bridge – Specific Resistance of a wire.			
6	Joly's bulb – Determination of pressure coefficient of air.			

7	Spectrometer – Solid prism – A, D and μ.			
8	NAND and NOR as Universal building blocks.			

Text Books

1. Anchal Srinivasa & R.K. Shukla, 2018, Practical Physics, New age International Publishers, 2nd edition.
2. C.C. Ouseph & V. Srinivasan, 1990, A text book of Physics Practical – Part I, S. ViswanathanPublishers, 1st edition.
3. C.C. Ouseph & G. Ranga Rajan, 1996, A text book of Physics Practical – Part II, S.Viswanathan Publishers, 1st edition.
4. S.P. Singh, 2000, Advanced Practical Physics II, Pragati Prakashan – Meerut, 12th edition.
5. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan – Meerut, 23rd edition.

Suggested Readings

1. S.P. Singh, 1999, Advanced Practical Physics with Viva – voce II, Pragati Prakashan – Meerut Burke, 23rd edition.
2. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan – Meerut Burke, 23rd edition.
3. M. Nelkon & J.M. Ogborn, 1967, Advanced level Practical Physics, Heinemann Educational Books. Ltd-London, 3rd edition.
4. M. Nelkon & J.M. Ogborn, 1941, A textbook of Practical Physics, Macmillan and Co & Limited, 4th edition.
5. Indu Prakash & Ramakrishna (Kitab Mahal), 2011, A Text Book of Practical Physics, 3rd edition.
6. Nelkon and Ogborn, 1978, Advanced level Practical Physics, Heinemann Edu. Publ., 4th edition.
7. D. Chattopadhyay& P. C Rakshit, 2011, An Advanced Course in Practical Physics, New Central Book Agency, 10th edition.
8. G.L. Squires, 2012, Practical Physics, Cambridge University Press, 4th edition.

Web Resources

1. https://vlab.amrita.edu/index.php?sub=1&brch=280&sim=210&cnt=2
2. https://vlab.amrita.edu/?sub=1&brch=280&sim=1509&cnt=1
3. https://rb.gy/m7bgb1
4. https://vlab.amrita.edu/?sub=1&brch=192&sim=847&cnt=1
5. http://vlabs.iitb.ac.in/vlabs – dev/labs/physics – basics/labs/carey – foster – bridge – iitk/simulation.html
6. https://academo.org/demos/logic – g_ate – simulator/
7. http://ov – au.vlabs.ac.in/optics/Spectrometer_Refractive_Index/
8. http://amv – au.vlabs.ac.in/advanced – mechanics/Compound_Pendulum/experiment.html

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Levels
CO1	Define the aim of the experiment and explain the various parameter in the formula that is used to estimate the physical properties of materials. Identify the equipment and get the accessories.	K1, K2
CO2	Arrange and assemble the gadgets and carryout the experiment.	K3
CO3	List the observations and repeat the experiment to find averages and hence determine the physical quantity by making use of the required formula.	K4
CO4	Interpret and report the result and classify the materials based on the measurement (or) verify a given law. Sketch the variations wherever required.	K5
CO5	Analyze the results of the experiment with an aim to construct or design an equipment or a device for use in project work/research work.	K6

Course Code	UPH 2301
Course Title	PHYSICS FOR CHEMISTRY
Credits	02
Hours/Week	04
Category	Allied Required (AR) – Theory
Semester	II
Regulation	2019

Course Overview

1. The aim of this course is to impart basic knowledge on the principles of Physics.
2. This course brings out the underlying connection between the various branches in Physics.
3. This course gives an overview on Newtonian dynamics and properties of matter in a coherent way.
4. Thermal Physics includes the kinetic theory of gases, velocity distribution and describes key concepts like thermodynamic laws.
5. Optics and Crystal Physics are also dealt in detail.

Course Objectives

1. To understand the basic principles of Physics.
2. To study the mechanical properties of the materials.
3. To learn the laws governing the behaviour of light.
4. To understand and apply the concepts of crystallography in material characterization
5. To apply the laws of motion to various simple system in mechanics.

Prerequisites	Basic knowledge in Physics.

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**MECHANICS** Distance and Displacement, velocity and acceleration – distance–time graph – velocity–time graph – motion in a plane– projectile motion – angular displacement, angular velocity, angular acceleration – uniform circular motion– centripetal and centrifugal force – oscillation of spring mass system – potential and kinetic energy variations – simple pendulum.	11	CO1, CO2, CO3,	K1, K2, K3, K4, K5, K6
II	**PROPERTIES OF MATTER** Elasticity – Hooke's law – different moduli of elasticity – Poisson's ratio – energy stored in a wire – relation between the elastic moduli – torsion in a wire. Viscosity and surface tension: coefficient of viscosity – Poiseuille's formula for the flow of liquid through a	11		

	capillary tube – variation of viscosity with temperature and pressure– excess pressure inside a curved liquid surface – spherical and cylindrical drops – Drop weight method of determining the surface tension of a liquid– interfacial Surface tension.		CO4, CO5	
III	**THERMODYNAMICS** Kinetic theory of gases – Boyle's law – Charles 's law – ideal gas equation – Joule – Kelvin effect – Porous Plug experiment – Avogadro's Hypothesis – molecular collisions – mean free path – spheres of influence – collision cross – section – expression for mean free path – variation of λ with temp and pressure – Laws of thermodynamics – Zeroth law – first law – second law of thermodynamics (statement only) – Concept of Entropy.	11		
IV	**OPTICS** Interference – interference of thin films – Air wedge – Newton's Rings – Diffraction – Fresnel and Fraunhoffer diffractions–Fraunhoffer diffraction at a single slit – diffraction at multiple slits – plane diffraction grating – determination of wavelength of a spectral line. Polarization: Double refraction of crystals.	11		
V	**CRYSTAL PHYSICS** Introduction – periodic array of atoms – crystal lattice – unit cell – basis – symmetry considerations – classification of crystals – Bravais lattices in three dimensions – crystal planes and Miller indices – simple crystal structures – Bragg's law – rotating crystal method.	11		

Text Books

1. R. Murugesan, 2010, Allied Physics, S. Chand & Co., 2010, Revised and enlarged edition.
2. D. S. Mathur, 1981, Mechanics, S.Chand & Co., 3rd edition.
3. Brijlal & Subramaniam, 2012, Optics, S. Chand & Co. New Edition.
4. V. Vijayendran, 2009, Integrated electronics, Viswanathan (printers and publishers) Pvt. Ltd., 1st edition.
5. Brijlal & Subramaniam, 2012, Heat Thermodynamics and Statistical Physics, S. Chand & Co. New Edition.
6. Arumugam, 2002, Material Science, Anuradha publications, 1st edition.

Suggested Readings

1. D. Halliday and R. Resnick, 2013, Fundamentals of Physics, Wiley Eastern, 6th edition.
2. Richard P. Feynman, Robert B. Leighton & Mathew Sands, 2006, Feynman lectures on Physics series, vol. 1, 2 & 3, Narosa publishing Ltd., The new millennium edition
3. M.A. Wahab, 2009, Solid State Physics, Narosa Publishing House, 2nd Edition.
4. H.S. Mani and G.K. Mehta, 1990, Introduction to Modern Physics, East west press pvt. Ltd.,1st edition.

5. H.C. Verma, 2017, Concepts of Physics (vol 1 & 2) Bharati Bhawan, 1st edition.

Web Resources:

1. https://nptel.ac.in/courses/112/106/112106286
2. https://www.youtube.com/watch?v=Yl43KpsNncw
3. https://nptel.ac.in/courses/112/105/112105123/
4. https://nptel.ac.in/courses/115/105/115105104/

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	Calculate the kinematical quantities for different types of motion.	K1, K2
CO 2	Determine the properties of materials such as elastic constants, surface tension and viscosity.	K3
CO 3	Relate the thermodynamic properties of matter to our daily life.	K4
CO 4	Explain the consequences of wave nature of light	K5
CO 5	Conclude the appropriate crystal structure for a given solid and learn their physical properties.	K6

Course Code	UPH 2302
Course Title	PHYSICS FOR CHEMISTRY PRACTICAL
Credits	01
Hours/Week	02
Category	Allied Required (AR) Practical
Semester	II
Regulation	2019

Course Overview

1. This course is designed to develop the practical laboratory skills to the allied students.
2. This course gives the opportunity to handle various Physics apparatus.
3. To perform the experiments and to learn the theory of it.
4. To acquire knowledge about elasticity, viscosity and surface tension of a material.

Course Objectives

1. To understand the relation between theory and experiment in Physics.
2. To gain practical knowledge by applying the experimental methods.
3. To acquire the skill of accurate measurement.
4. To measure the various mechanical and thermal properties of materials.

Pre requisites	Basic knowledge on Physics practical.

SYLLABUS

S.No	List of experiments	Hours Per week Per	COs	Cognitive levels
1	Young's modulus by stretching – Vernier microscope	2	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
2	Rigidity modulus –Torsional Pendulum			
3	Surface tension and interfacial tension – method of drops			
4	Surface tension – capillary rise			
5	Viscosity – capillary flow			
6	Specific heat of liquid – electrical Heating			
7	Sonometer – Verification of laws			
8	Compound bar pendulum – determination of g and radius of			

	gyration.			

Text Books

1. C.C. Ouseph & V. Srinivasan, 1990, A text book of Physics Practical – Part I, S. ViswanathanPublishers, 1st edition.
2. C.C. Ouseph & G. RangaRajan, 1996, A text book of Physics Practical – Part II, S.Viswanathan Publishers, 1st edition.

Suggested Readings

1. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan – Meerut, 23rd edition.

Web Resources

1. https://www.youtube.com/watch?v=8dZxWOTMRwA
2. https://rb.gy/jp3h0l
3. https://www.youtube.com/watch?v=kjMfwS857Uw
4. https://rb.gy/e1lzux
5. https://www.youtube.com/watch?v=2vk0F7bwBzw
6. https://rb.gy/zzdvdd
7. https://www.youtube.com/watch?v=gnhotr13e6U

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	Apply the concept of elasticity in lab	K1, K2
CO 2	Estimate the viscosity and surface tension of some liquids through simple experiments.	K3
CO 3	Verify the laws of transverse vibration using a sonometer.	K4
CO 4	Identify the specific heat capacity of the given iquid.	K5
CO 5	Develop the experimental skill for various types of measurement.	K6

Course Code	UPH 3501
Course Title	ELECTRICITY AND MAGNETISM
Credits	06
Hours/Week	06
Category	Major Core (MC) – Theory
Semester	III
Regulation	2019

Course Overview

1. This course focus on the fundamental Physics of the distribution of fields near electric charge configuration which is mandatary for undergraduate Physics student. This course gives a basic understanding about the movement of charges inside the electrical conductor and the magnetic phenomena.
2. The various effects of electric field and the various types of energy storage devices will be discussed in detail.
3. The magnetic effects of steady and time varying currents will be introduced.
4. Electro Magnetic (EM) wave is the backbone of communication system. This course will help the learners to understand the behavior of electric and magnetic field in EM wave.

Course Objectives

1. To understand the properties of electric charge and various phenomena of Electrostatics.
2. To learn the types of material and their properties used in electricity transmission.
3. To evaluate the magnetic fields due to different configurations of current carrying elements.
4. To understand the combined effect of electric and magnetic fields.
5. To apply the knowledge of electric and magnetic fields in understanding the propagation of EM wave.

Prerequisites	Basic knowledge of calculus and series expansion.

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**ELECTROSTATICS** Properties of charges – Coulomb's law and its validity – Examples – superposition principle (Discrete and continuous charge distribution) – Examples – Field concept – Scalar potential – Field and potential due to continuous charge distribution (line, ring and disc charge configurations) – Energy consideration – Relations between field and potential – Flux and lines of force – Solid angle – Integral and differential form of Gauss law – Linear charge distribution (uniform line charge density), Surface charge distribution (disc) – Volume	15		

	charge distribution (uniform spherical charge distribution) – Solutions of Laplace equation (two infinite parallel surfaces) – Electric dipole – potential and field due to an electric dipole.			
II	**CONDUCTORS, CAPACITORS AND DIELECTRICS** Properties of conductors – Capacitance – Parallel plate capacitor – Energy and energy density – Spherical capacitor – Combination of capacitances – Energy consideration – Classical radius of an electron – Polarization density – Electronic polarizability of atoms – Polarization charge densities (surface and volume) – Relation between D, E and P, Gauss's law in the presence of a dielectric – Boundary condition on D and E – Dielectric breakdown.	15		
III	**MAGNETIC INDUCTION** Sources of magnetic induction B – properties of B – Magnetic induction due to long, straight current – Ampere's law – Circular loop – Helmholtz coil – Definition of ampere – Magnetic induction inside a conductor – Magnetic dipole – Gyromagnetic ratio – Solenoid and toroid.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**MOTION OF CHARGED PARTICLE AND EM INDUCTION** Charged particle in uniform magnetic field – Force on current in a magnetic field – Current loop in uniform B – Potential energy of a dipole in uniform B – Charged particle in EM field – Faraday's law – Differential form – Different mechanism for change of flux – Motional EMF – Mutual inductance – Self – inductance (long solenoid, straight wire).	15		
V	**ELECTROMAGNETIC WAVES** The displacement current – Ampere's law in general form – Maxwell's equations – Poynting vector – wave equation – Plane electromagnetic waves – energy considerations.	15		

Text Book

1. A S Mahajan, A A Rangwala, Electricity and Magnetism, 2017, McGraw Hill, 1st Edition

Suggested Readings

1. David J. Griffith, Introduction to Electrodynamics, 2012, PHI, New Delhi, 4th edition.
2. E. M. Purcell, David Morin, Electricity and Magnetism, 2013, Cambridge university press, 3rd edition.
3. I. E. Irodov, Basic laws of Electromagnetism, 2019, New age international publishers, 5th edition.
4. Navina Wadhwani, Electricity and Magnetism, 2007, PHI, New Delhi, 1st edition.
5. K.K Tewari, Electricity and Magnetism, S Chand & Co, New Delhi, 3rd edition.
6. Halliday – Resnick and Walker, Fundamentals of Physics, 2013, Wiley India Pvt. Ltd., 10th edition.

Web Resources

1. https://www.thoughtco.com/introduction-electricity-and-magnetism-4172372
2. http://web.mit.edu/sahughes/www/8.022/
3. http://orca.phys.uvic.ca/~tatum/elmag.html
4. https://phys.libretexts.org/Bookshelves/Electricity_and_Magnetism
5. https://www.electricityforum.com/electricity-and-magnetism
6. https://openpress.usask.ca/Physics155/

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	Apply Coulombs law and Gauss law to determine the electric field due to various charge configurations.	K1, K2
CO 2	Ability to design capacitors using the concepts of electric field and dielectrics.	K3
CO 3	Measure and map the magnetic effects of electric currents and apply it in physical experiments.	K4
CO 4	Analyze the role of Faradays law in designing various types of AC systems.	K5
CO 5	Apply the concepts of electrodynamics to describe the behaviour of EM waves in different media	K6

Course Code	UPH 3502
Course Title	MATHEMATICAL PHYSICS – II
Credits	03
Hours/Week	03
Category	Major Core (MC) – Theory
Semester	III
Regulation	2019

Course Overview

1. Physics is the study of Partial Differential Equations. This course helps to understand the basic knowledge of wave equation, Fourier series and various modes of vibration of strings.
2. Heat equation is introduced so that student will be able to model the heat transfer phenomena in solids. Laplacian operator is also introduced and its functional form in various coordinates system are discussed. At the end of the unit, a brief outline of boundary value problems is given.
3. Fourier transform is natural extension of Fourier series. This course introduces the basic properties of Fourier transform and also demonstrates how the Fourier transform is applied in sampling the signals.
4. Numerical method is one of the most practical way of handling physical calculations. In this course, various interpolations and Curve fitting methods are discussed with suitable examples.
5. Numerical integration techniques such as Trapezoidal and Simpson rule and numerical differentiation techniques such as Euler's basic and improved methods are discussed.

Course Objectives

1. To introduce the basic formalism of wave equation and enable the students to analyze the various modes of vibration of string.
2. To enable the students to model the heat transfer phenomena and apply the heat equation in real world examples.
3. To introduce the basic properties of Fourier, transform and enable the students to correlate the application of Fourier transform in signal processing, quantum mechanics etc.,
4. To enable the students to apply the various interpolation techniques in physical measurements.
5. To do the integrations and differentiation that are not possible to solve analytically and enable the students to apply these techniques in physical phenomena.

Prerequisites	1. Basic knowledge of integration and differentiation. 2. Fundamentals of school level Physics.

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**PARTIAL DIFFERENTIAL EQUATIONS – I** Basic concepts – Vibrating string, One dimensional wave equation – Separation of variables (product method) – Use of Fourier series – Examples – D' Alembert's solution of the wave equation	9	CO1, CO2, CO3, CO4, CO5	K1, K2,K3,K4,K5,K6
II	**PARTIAL DIFFERENTIAL EQUATIONS- II** Heat Equation: Solution by Fourier series – Examples – Representation of Laplacian in polar coordinates, cylindrical and spherical coordinates (No derivation) – Boundary value problem in spherical coordinates.	9		
III	**FOURIER TRANSFORM** Fourier Sine and Cosine transforms – Examples – Properties (Linearity, derivative) Fourier transforms and inversion – Definitions – Physical interpretation – Properties of Fourier transform (linearity, derivative and convolution) – Examples	9		
IV	**NUMERICAL METHODS – I** Interpolation – Forward difference table – Newton's forward and backward interpolation formula – Lagrange's interpolation for unequally spaced data – System of linear equations – Curve fitting by method of least squares	9		
V	**NUMERICAL METHODS – II** Numerical integration: Trapezoidal and Simpson's $1/3^{rd}$ rule – Differential equations: First order differential equation – Euler's method and improved Euler method. Roots of polynomials (Newton-Raphson method)	9		

Text Books

1. Erwin Kreyzig, 1991, Advanced Engineering Mathematics, Wiley Eastern Ltd., 8^{th}Edition.
2. H. K. Dass, 2010, Mathematical Physics, S. Chand Publishing, 1^{st} edition.
3. M.K. Venkatraman, 1999, Numerical methods in science and Engineering (Unit – 4 & 5), The national publishing company, 5^{th} edition.

Suggested Readings

1. George Arfken, Hans Weber, 2003, Mathematical methods for Physicists, Academic Press, 6^{th} edition.
2. V. Balakrishnan, 2019, Mathematical Physics with Applications, Problems and solutions, ANE books, 1^{st} edition.
3. Mary L. Boas, 2006, Mathematical methods in Physical Sciences, Wiley, 3^{rd} edition.
4. Riley & Hobson, 2011, Mathematical methods for Physical Sciences, Cambridge University Press, 3^{rd}

edition.

5. S.S. Sastry, 2004, Introductory methods in numerical analysis, PHI publication, 3rd edition.

Web Resources

1. https://www.youtube.com/watch?v=9WZM68aVnGk
2. https://www.youtube.com/watch?v=9TQCKWWAVjM
3. https://www.youtube.com/watch?v=i8rnEl8O-r0
4. https://www.youtube.com/watch?v=-D4GDdxJrpg
5. https://www.youtube.com/watch?v=spUNpyF58BY
6. https://www.youtube.com/watch?v=lkAvgVUvYvY
7. https://www.youtube.com/watch?v=gZNm7L96pfY&list=PLB24BC7956EE040CD
8. https://www.youtube.com/watch?v=oY1F9QGLdTY
9. https://www.youtube.com/watch?v=GLSdCEwP2LI
10. https://www.youtube.com/watch?v=LjfACk-ugas
11. https://www.youtube.com/watch?v=q87L9R9v274
12. https://www.youtube.com/watch?v=o9MUMlWA5IE

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	Write down the differential equation governing the physical phenomena.	K1, K2
CO 2	Analyze different periodic functions by applying Fourier transform technique.	K3
CO 3	Apply numerical methods to solve problems in Physics.	K4
CO 4	Ability to solve differential equations using numerical techniques.	K5
CO 5	Capacity to integrate different functions using Numerical technique.	K6

Course Code	UPH 3503
Course Title	PHYSICS PRACTICAL – III
Credits	03
Hours/Week	03
Category	Major Core (MC) – Practical
Semester	III
Regulation	2019

Course Overview

1. The course provides the knowledge to measure various physical quantities through scientific approach.
2. This course aims to understand basic concepts in optics and measurement of various properties of matter like elasticity and viscosity using scientific apparatus.
3. This course provides the fundamental concepts of semiconductor devices and their use as amplifiers.

Course Objectives

1. To determine the viscosity of a highly viscous liquid using Searle's viscometer.
2. To estimate the Young's modulus of elasticity of a given material by uniform and non – uniform bending.
3. To calculate the figure of merit of a Table galvanometer and ballistic galvanometer.
4. To design a RC coupled amplifier and analyze its frequency response.
5. To verify the wavelengths of mercury spectrum using spectrometer and grating.

Prerequisites	Basic knowledge on usage of scientific apparatus.

SYLLABUS

S.No	List of experiments	Hours Per week	COs	Cognitive levels
1	Searle's viscometer–determination viscosity of a highly viscous liquid.	3	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
2	Determination of Young's modulus of a material – pin and microscope – uniform and non – uniform bending.			
3	Determination of wavelength of mercury spectrum by the method of normal incidence–grating.			
4	Table galvanometer – determination of figure of merit.			
5	Temperature coefficient of resistance – Carey-Foster's bridge.			
6	B.G – determination of figure of merit.			
7	Transistor – RC coupled amplifier.			

8	Spectrometer – determination of refractive index of a liquid – hollow prism.			

Text Books

1. Anchal Srinivasa & R.K. Shukla, 2018, Practical Physics, New age International Publishers, 2nd edition.
2. C.C. Ouseph & V. Srinivasan, 1990, A text book of Physics Practical – Part I, S. ViswanathanPublishers, 1st edition.
3. C.C. Ouseph & G. RangaRajan, 1996, A text book of Physics Practical – Part II, S.Viswanathan Publishers, 1st edition.

Suggested Readings

1. S.P. Singh, 2000, Advanced Practical Physics II, Pragati Prakashan – Meerut, 12th edition.
2. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan – Meerut, 23rd edition.
3. M. Nelkon & J.M. Ogborn, 1941, A textbook of Practical Physics, Macmillan and Co & Limited, 4th edition
4. H.S. Aller & H. Moore, 1941, A textbook of Practical Physics, Macmillan and Co & Limited, 5th edition.

Web Resources

1. https://vlab.amrita.edu/?sub=3&brch=190&sim=339&cnt=1
2. https://vlab.amrita.edu/?sub=1&brch=280&sim=1509&cnt=1
3. https://vlab.amrita.edu/?sub=1&brch=280&sim=550&cnt=1
4. https://vlab.amrita.edu/?sub=1&brch=281&sim=334&cnt=2
5. http://amrita.olabs.edu.in/?sub=1&brch=6&sim=152&cnt=2
6. https://vlab.amrita.edu/index.php?sub=1&brch=192&sim=346&cnt=2
7. https://vlab.amrita.edu/?sub=3&brch=223&sim=983&cnt=1
8. http://ov – au.vlabs.ac.in/optics/Spectrometer_Refractive_Index/

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	Define the aim of the experiment and explain the various parameter in the formula that is used to estimate the physical properties of materials. Identify the equipment and get the accessories.	K1, K2
CO 2	Arrange and assemble the gadgets and carryout the experiment.	K3
CO 3	List the observations and repeat the experiment to find averages and hence determine the physical quantity by making use of the required formula.	K4
CO 4	Interpret and report the result and classify the materials based on the measurement. (or)Verify a given law. Sketch the variations wherever required.	K5
CO 5	Analyze the results of the experiment with an aim to construct or design an equipment or a device for use in project work / research work.	K6

Course Code	UPH 3401
Course Title	NUMERICAL METHODS AND C++ PROGRAMMING
Credits	02
Hours/Week	03
Category	Allied Optional (AO) - Theory
Semester	III
Regulation	2019

Course Overview

1. This course introduces numerical methods and C++ programming.
2. It will provide mathematical tools for solving This involves solving algebraic, transcendental, nonlinear equations, ordinary differential equations and numerical integration.
3. C++ is a very powerful and versatile language. The basics of programming, writing code, editing, and compiling will be dealt with.
4. Apply C++ to solve numerical problems.

Course Objectives

1. To introduce the basic elements of numerical methods.
2. To teach the basics of approximation, integration and differentiation.
3. To give an overview of the data types, program control statement, arrays, strings in C++.
4. To enable the students to decode simple programs in C++.
5. To demonstrate the Application of C++ programming in solving problems in numerical methods.

Prerequisites	Basic knowledge on Mathematics.

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**SOLUTIONS OF ALGEBRAIC, TRANSCENDENTAL& SIMULTANEOUS EQUATIONS AND INTERPOLATION** Bisection method – Method of successive approximation – Newton – Raphson method – Regula Falsi method – Solutions of system of linear equations: Gauss elimination – Gauss Jordan and Gauss - Seidal methods – Interpolation: Lagrange and Newton's formula.	8	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**NUMERICAL INTEGRATION AND DIFFERENTIATION METHODS** Numerical Integration: Simpson's rule, Trapezoidal rule – Numerical solution to ordinary differential equations: Euler, Modified Euler and Runge – Kutta methods.	8		
III	**INTRODUCTION TO C++** Structure of C++, Fundamentals of C++ – Character set – Identifiers and keywords – Data types –			

	Constants – Variables – Declarations – Expressions – Arithmetic, relational, logical, assignment, increment and decrement – Conditional, bitwise, special operators – Arithmetic operators.	6		
IV	**PROGRAMMING IN C++** Basic program structure – Control Flow; if, while, for nested loops, do – while, switch, break, continue and go to statements	9		
V	**ARRAYS AND FUNCTIONS** Functions – Forms of C++ functions – Return values and their types – Calling a function – Category of functions – Application oriented programs.	8		

Text Books

1. Sastry S.S., 2012, Introductory methods of Numerical Methods, Prentice Hall Ltd., 5th edition
2. M. K. Jain, S.R.K. Iyengar, R.K. Jain, 2007, Numerical methods for scientific and engineering computation, New Age International Publishers, 5th edition.
3. J N Sharma, 2008, Numerical Methods for Engineers and Scientists, , Narosa Publishing House, 2nd edition.
4. E. Balagurusamy, 202, Object oriented programming with C++, McGraw Hill Education India Private Limited, 6th edition.
5. P. Kanetkar, 2003, Let us C++, Yashavant , BPB publications, 2nd edition.

Suggested Readings

1. M.K. Venkataraman, 1995, Numerical Methods in Science and Engineering, , The National Publishing Company – Madras, 5th edition.
2. Herbert Schildt, 2008, Teach yourself C++, Tata McGraw Hill, 3rd edition.

Web Resources

1. http://www.nptelvideos.in/2012/11/numerical-methods-and-programing.html
2. http://www.nptelvideos.com/programming/
3. https://nptelvideos.com/lecture.php?id=1462
4. https://nptelvideos.com/lecture.php?id=1467

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	Identifying suitable mathematical tool for solving problems using numerical methods.	K1, K2
CO 2	Solve algebraic or transcendental equations, numerical solutions of differential equations using Euler, Modified Euler and Runge Kutta methods.	K3
CO 3	Perform numerical integration using Trapezoidal and Simpson's method.	K4
CO 4	Write simple programs in C++ using arithmetic and logical instructions.	K5
CO 5	Execute numerical problems applied in Physics through computer programs.	K6

Course Code	UPH 3402
Course Title	NUMERICAL METHODS AND C++ PROGRAMMING LAB
Credits	01
Hours/Week	02
Category	Allied Optional (AO) – Practical
Semester	III
Regulation	2019

Course Overview

1. This course deals with the application of C++ to solve numerical problems.

Course Objectives

1. To code and execute simple programs in C++.
2. To write simple programs involving arrays in C++.
3. To learn the application of C++ programming in solving problems.

Prerequisites	Basic knowledge on C++ programming.

SYLLABUS

S.No	List of experiments	Hours Per week	COs	Cognitive levels
1	Simple arithmetical programs – addition, subtraction, multiplication, division, factorial, solving simple mathematical expressions.	2	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
2	Finding the largest and smallest number in an array, sorting in ascending and descending order, generating a sequence of numbers.			
3	Roots of polynomials by bisection method & Newton – Raphson Method.			
4	Roots of polynomials by successive approximation method &Regula Falsi method.			
5	Solving a system of linear equations – Gauss elimination and Gauss-Jordan methods.			
6	Lagrange's interpolation.			
7	Numerical integration by Trapezoidal and Simpson's 1/3rule.			
8	Numerical solutions of Ordinary first order differential equations by Euler and Runge-Kutta methods.			

Text Books

1. J N Sharma, 2008, Numerical Methods for Engineers and Scientists, Narosa Publishing House, 2nd edition.
2. E. Balagurusamy, 2012, Object oriented programming with C++, McGraw Hill Education India Private Limited, 6th edition.
3. P. Kanetkar, 2003, Let us C++, Yashavant, BPB publications, 2nd edition

Suggested Readings

1. M.K. Venkataraman, 1999, Numerical Methods in Science and Engineering, The National Publishing Company – Madras, 5th edition.
2. Herbert Schildt, 2008, Teach yourself C++,Tata McGraw Hill, 3rd edition.

Web Resources

1. http://www.nptelvideos.in/2012/11/numerical – methods – and – programing.html
2. http://www.nptelvideos.com/programming/
3. https://nptelvideos.com/lecture.php?id=1462
4. https://nptelvideos.com/lecture.php?id=1467

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	Write simple programs in C++ using arithmetic and logical instructions.	K1, K2
CO 2	Develop programs in C++ involving strings.	K3
CO 3	Perform numerical integration using Trapezoidal and Simpson's method using C++.	K4
CO 4	Evaluate numerical solutions of differential equations using Euler, Modified Euler and Runge Kutta methods implementing C++ programming.	K5
CO 5	Develop programs in C++ to solve Lagrange's interpolation.	K6

Course Code	UPH 3403
Course Title	APPLIED ELECTRONICS
Credits	02
Hours/Week	03
Category	Allied Optional (AO) -Theory
Semester	III
Regulation	2019

Course Overview

1. This course focuses on the basics of semiconductor devices and understanding of electronic components.
2. The aim of the course is to explore the working of electronic circuits and its components.
3. The course provides an opportunity to learn different types of various diodes .
4. It teaches the fundamentals of memory devices.
5. This course trains graduates on cutting edge technology and making them employable.

Course Objectives

1. To understand the concepts of semiconductor devices.
2. To comprehend the behavior of special purpose diodes like LEDs.
3. To understand the basic construction and working of an operational amplifier.
4. To explore different types of memory devices and their applications.

Prerequisites	Basic knowledge of Physics and electronics.

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**SEMICONDUCTORS DEVICES** Semiconductor – Bonds and types in semiconductors – PN junction diode – Properties – biasing a PN junction diode – Current flow – VI characteristics of PN junction diode – Limitations.	10	CO1, CO2, CO3, CO4, CO5	K1,K2,K3,K4,K5,K6
II	**SPECIAL PURPOSE DIODES** Zener diode – Light emitting diode (LED) – LED voltage and current – advantages and application of LED'S – Photo diode operation, characteristics and applications.	10		

III	**OPERATIONAL AMPLIFIERS** Introduction – Characteristics of an Ideal and practical Op – Amp (IC 741), CMRR – Applications of Op – Amps – Inverting amplifiers – Non – inverting Amplifiers – Summing amplifier – Difference amplifier.	10		
IV	**TIMER AND APPLICATIONS** 555 Timer – Internal clock diagram and working – Applications of 555 Timer – Schmitt trigger, Astable and monostable mulitivibrators.	10		
V	**MEMORY DEVICES** Introduction – Semiconductor memory – Types and characteristics – RAM – ROM – Magnetic memory – Magnetic recording – Magnetic tape – Hard disks – Optical memory.	10		

Text Books

1. V. K. Mehtha, 2010, Principles of Electronics, S. Chand & Co., 11th edition.
2. A.P. Malvino, D.P. Leach, Gautam Saha, 2011, Digital Principles and Applications, Tata McGraw – Hill Education, 11th edition.
3. S. L. Gupta, V. Kumar, 2012, Handbook of Electronics, Pragati Prakashan
4. R.P. Jain, 2009, Modern Digital Electronics, Tata McGraw – Hill Education, 4th Edition

Suggested Readings

1. V. Vijayendran, 2009, Introduction to Integrated Electronics, S., Printers& Publishers Private. Ltd., 1st edition.
2. Chattopadhay, D. and Rakshit, 2010, Electronics Fundamental and applications, New age publishers, 11th edition
3. Ramakant A. Gayakwad, 2009, Op – amps and Linear Integrated circuits. PHI Learning, 4th edition,

Web Resources

1. Basic Electronics (rice.edu)
2. Basic Electronics Concepts - Tutorials » Electronics Notes (electronics-notes.com)
3. Basic Electronics Tutorials and Revision (electronics-tutorials.ws)
4. Introduction to Basic Electronics, Electronic Components and Projects (makerspaces.com)
5. Operational Amplifier Basics - Op-amp tutorial (electronics-tutorials.ws)

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	Identify the nonlinear characteristics of PN junction diode.	K1, K2
CO 2	Apply the knowledge of semiconductors devices to illustrate the functioning of basic electronic circuits	K3
CO 3	Use (IC 741) operational amplifier for addition and subtraction.	K4
CO 4	Analyze the applications of IC 555 timer	K5
CO 5	Distinguish between the organization of various parts of a system memory hierarchy.	K6

Course Code	UPH 3404
Course Title	APPLIED ELECTRONICS (LAB)
Credits	01
Hours/Week	02
Category	Allied Optional (AO)-Practical
Semester	III
Regulation	2021

Course Overview

1. This course intends to develop experimental skills to have a better understanding of electronic components.
2. Students will be able to analyze basic characteristic of operational amplifiers through hands on experience.
3. The basic concepts of applied electronics will be understood by designing circuits.

Course Objectives

1. To construct Summing amplifier using op amp.
2. To construct a circuit for light to frequency converter using 555 timer.
3. To verify the output voltage of difference amplifier using op amp.
4. To calculate the frequency of vibrations by constructing Astable multivibrator.
5. To design a circuit for inverting and non-inverting amplifier using op amp.
6. To calculate the forward and reverse characteristics of Zener diode.

Prerequisites	Basic knowledge on usage of electronic apparatus

SYLLABUS

S.No	List of experiments	Hours Per week	COs	Cognitive levels
1	Op Amp – Inverting and non – inverting amplifiers	2	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
2	Op Amp – Summing amplifier			
3	Op Amp – Difference amplifier			
4	555 Timer – Astable multivibrator			
5	555 timer – Light to frequency converter			
6	Zener diode – forward and reverse characteristics			
7	555 timer – Flasher circuit			

8	Op Amp – Astable multivibrator			

Text Books

1. Ian Sinclair, John Dunton, 2018, Practical Electronics Handbook, Elsevier Publishers, 6th edition.
2. C.C. Ouseph & V. Srinivasan, 1990, A text book of Physics Practical – Part I, S. ViswanathanPublishers, 1st edition.
3. C.C. Ouseph & G. RangaRajan, 1996, A text book of Physics Practical – Part II, S.Viswanathan Publishers, 1st edition.
4. Paul Scherz, Simon Monk, 2016, Practical electronics for inventors, Mc Graw Hill Education, 4th edition.
5. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan-Meerut, 23rd edition.

Suggested Readings

1. John M. Huges, 2015, Practical Electronics, Schroff O'Reilly, 1st edition.
2. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan-Meerut Burke, 23rd edition.
3. M. Nelkon & J.M. Ogborn, 1967, Advanced level Practical Physics, Heinemann Educational Books. Ltd-London, 3rd edition.
4. M. Nelkon & J.M. Ogborn, 1941, A textbook of Practical Physics, Macmillan and Co &Limited, 4th edition.
5. Indu Prakash & Ramakrishna, A Text Book of Practical Physics, Kitab Mahal, 3rd edition.
6. Nelkon and Ogborn, 1978, Advanced level Practical Physics, Heinemann Edu. Publ., 4th edition.
7. D. Chattopadhyay & P. C Rakshit, 2011, An Advanced Course in Practical Physics, New Central Book Agency, 10th edition.

Web Resources

1. https://youtu.be/RSWsJjUqD2w
2. https://youtu.be/HQUmkPinhBg.
3. https://youtu.be/ou9z7iqcelE
4. https://youtu.be/2QNfOcqPdvM5.
5. https://youtu.be/i0SNbdkYI
6. https://youtu.be/jrQ48FSqRZs

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Levels
CO1	Determine the frequency of vibrations using Astable multivibrator.	K1, K2
CO2	Identify the output voltage of a summing amplifier using Op amp.	K3
CO3	Evaluate the forward and reverse characteristics of Zener diode.	K4
CO4	Device a circuit for light to frequency converter using 555 timer.	K5
CO5	Analyze the voltages for inverting and non-inverting amplifier using Op amp.	K6

Course Code	UPH 3405
Course Title	DIGITAL ELECTRONICS
Credits	02
Hours/Week	03
Category	Allied Optional (AO) -Theory
Semester	III
Regulation	2019

Course Overview

1. In this course, students will gain sufficient knowledge about the basic understanding of mathematical logic behind digital electronics.
2. It helps the students to understand the number system and combinational logic circuits.
3. This course focuses on the design and analysis of electronic circuits.
4. Effectively use register and counters for designing various electronic circuits.

Course Objectives

1. To acquaint the students with the fundamental principles of binary logic and various devices.
2. To understand the concept of different number systems.
3. To comprehend the basic knowledge of logic gates which is very much essential for understanding the behavior of electronic circuits.
4. To make the students understand and working of Integrated circuits Boolean algebra and flips flops will help them.
5. To make students understand the application of register and counters.

Prerequisites	Basic knowledge on Physics and electronics

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**NUMBER SYSTEM** Binary number systems – Binary to decimal conversion – Decimal to binary conversion – Octal numbers – Hexadecimal numbers	10	CO1, CO2, CO3, CO4, CO5	K1,K2,K3,K4,K5,K6
II	**LOGIC GATES** Basic gates – NOT, OR, AND – Universal logic gates – NOR, NAND, AND, OR, Invert gates – Positive and negative logic.	5		
III	**BOOLEAN ALGEBRA** Boolean laws and theorems – Sum-of-products method	10		

	– Truth table for Karnaugh Map – Pairs, Quads, and Octets – Karnaugh simplifications.			
IV	**FLIP FLOP** Introduction – NAND latch – SR flip flop – D flip flop – JK flip flop – T flipflop.	10		
V	**REGISTERS & COUNTERS** Shift left shift register – Shift right shift register – Up counter – Down counter – Mod n counter (mod 4 and mod 8)	10		

Text Books

1. A.P. Malvino, D.P. Leach, Gautam Saha, 2011, Digital Principles and Applications, Tata McGraw – Hill Education, 11th edition.
2. V. Vijayendran, 2009, Introduction to Integrated Electronics, Viswanathan S., Printers & Publishers Private. Ltd.,1st edition.

Suggested Readings

1. Gupta S.L. Kumar, 2012, Handbook of Electronics, Pragati Prakashan., 23rd edition.
2. R.P. Jain, 2012, Modern Digital Electronics, Tata McGraw – Hill Education, 4th Edition.
3. Chattopadhay D. and Rakshit, 2010, Electronics Fundamental and applications, New age publishers, 11th edition.

Web Resources

1. Digital Number System – Tutorialspoint
2. Number System in Digital Electronics Tutorial – Javatpoint
3. The Mathematics of Boolean Algebra (Stanford Encyclopedia of Philosophy)
4. Boolean Algebra – Tutorialspoint
5. Basic Electronics (rice.edu)
6. Basic Electronics Concepts – Tutorials » Electronics Notes (electronics – notes.com)
7. Basic Electronics Tutorials and Revision (electronics – tutorials.ws)
8. Introduction to Basic Electronics, Electronic Components and Projects (makerspaces.com)
9. Operational Amplifier Basics – Op – amp tutorial (electronics – tutorials.ws)
10. Operational Amplifiers Basics, Characteristics, Types and Applications (elprocus.com)

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	Identify and distinguish between different number systems related to computers.	K1, K2
CO 2	Check and verify the truth tables of various logic gates.	K3
CO 3	Simplify logic statements using K – map.	K4
CO 4	Identify the use of different types of Flip flops.	K5
CO 5	Implement various counters using Flip flops.	K6

Course Code	UPH 3406
Course Title	DIGITAL ELECTRONICS LAB
Credits	01
Hours/Week	02
Category	Allied Optional (AO)-Practical
Semester	III
Regulation	2019

Course Overview

1. The course enables the students to acquire practical knowledge in physics.
2. The idea of this course is to familiarize the use of various logic gates by doing simple experiments.
3. To introduce them to use Karnaugh map Basic concepts for simplifying circuits.
4. Students will be able to design counters and shift registers using the electronic components.

Course Objectives

1. To construction of basic logic gates using distinct components.
2. To solving Karnaugh map using three variables.
3. To designing a 4 – bit synchronous up and down counters.
4. To construction of NAND and NOR as universal gates.
5. To verification of truth table using shift left and shift register.
6. To study and construct the operation of mod 4, 8 counters.

Prerequisites	Basic knowledge on usage of scientific apparatus

SYLLABUS

S.No	List of experiments	Hours Per week	COs	Cognitive levels
1	Basic Logic gates – AND,OR, NOT	2	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
2	Karnaugh map – 3 variables			
3	4 bit up and down counters			
4	Shift left and shift rightregister			
5	NAND & NOR as Universalbuilding blocks			

6	Up counter			
7	Down counter			
8	Mod 4, 8 counter			

Text Books

1. Ian Sinclair, John Dunton 2018, Practical Electronics Handbook, Elsevier Publishers., 6th edition.
2. C.C. Ouseph & V. Srinivasan, 1990, A text book of Physics Practical-Part I, S. Viswanathan Publishers, 1st edition.
3. C.C. Ouseph & G. Ranga Rajan, 1996, A text book of Physics Practical-Part II, S. Viswanathan Publishers, 1st edition.
4. Paul Scherz, Simon Monk, 2016, Practical electronics for inventors, Mc Graw Hill Education, 4th edition.
5. S.L. Gupta & V. Kumar, 1999 Practical Physics, Pragati Prakashan-Meerut, 23rd edition.

Suggested Readings

1. John M. Huges, 2015, Practical Electronics, Schroff O'Reilly, 1st edition.
2. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan-Meerut Burke, 23rd edition.
3. M. Nelkon & J.M. Ogborn, 1967, Advanced level Practical Physics, Heinemann Educational Books. Ltd-London.
4. M. Nelkon & J.M. Ogborn, 1967, Advanced level Practical Physics, Heinemann Educational Books. Ltd-London, 3rd edition.
5. M. Nelkon & J.M. Ogborn, 1941, A textbook of Practical Physics, Macmillan and Co & Limited, 4th edition.
6. Indu Prakash & Ramakrishna (Kitab Mahal), 2011, A Text Book of Practical Physics, 3rd edition.
7. Nelkon and Ogborn, 1978, Advanced level Practical Physics, Heinemann Edu. Publ., 4th edition.
8. D. Chattopadhyay & P. C Rakshit, 2011, An Advanced Course in Practical Physics, New Central Book Agency, 10th edition.

Web Resources

1. https://youtu.be/RSWsJjUqD2w
2. https://youtu.be/HQUmkPinhBg
3. https://youtu.be/ou9z7iqcelE
4. https://youtu.be/2QNfOcqPdvM5
5. https://youtu.be/i0SNb__dkYI
6. https://youtube/jrQ48FSqRZs

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Levels
CO1	Construct basic logic gates AND, OR, NOT	K1, K2
CO2	Solve Karnaugh map using three variables.	K3
CO3	Design 4 bit up and down counters.	K4
CO4	Verify the truth table using shift left and shift right register	K5
CO5	Demonstrate NAND & NOR as Universal Building blocks	K6

Course Code	UPH 3801
Course Title	WORKSHOP PRACTICE AND WIRING
Credits	02
Hours/Week	03
Category	Non-Major Elective (NME) – Theory
Semester	III
Regulation	2019

Course Overview

1. The course enables other department students to understand the basic workshop equipment and techniques.
2. The students will be acquiring the basic knowledge of measuring devices applicable in workshops.
3. The basic principle of lathe operation will be made feasible.
4. House wiring and troubleshooting will be explained and students will be having hands on experience.
5. Workshop practice will help the student to understand the various application of tools.

Course Objectives

1. To understand the working of Lathe.
2. To classify the tools for cutting, drilling and threading.
3. To perform house wiring and troubleshooting.
4. To identify suitable measuring devices and tools for making useful objects.
5. To construct devices like switch box, tray, pen stand etc.

Prerequisites	Familiarity with workshop tools and electrical connections

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**MEASURING DEVICES** Scales – Dividers – Dial protractor – Bevel protractor – Try square – Micrometers– Types–Vernier calipers–s gauge	04	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**LATHE** Lathe types – Different parts – Accessories – Lathe work.	04		
III	**CUTTING AND THREADING** Hacksaw – Chisels – Files – Lathe cutting tools – V – block and L – block – Angle plate – Screw thread – Taps and dies – Cutting speed – Quick return mechanism.	04		

IV	**DRILLING AND GRINDING** Drill bits – Types – Drill chuck – Reamers – Drilling machines – Types – Grinding – Types of tools – Shapes – Setting tools in tool posts – Grinding wheels.	04		
V	**WIRING** Electric current – Potential – Ohm's law – One way and two-way switches – Fuse – Miniature Circuit Breaker (MCB) – Live, neutral and earth wires – Three phase connection.	04		

Text Books

1. S K Hajra Choudhury, S K Bose, K Hajra Choudhury, Nirjhar Roy, S C Bhattacharya, 2007, Element of workshop technology/Vol.2, Machine Tools, Asia Pub. House, 12th Edition.
2. Myron L. Begeman, B. H. Amstead, Manufacturing Process, John Wiley & Sons Inc., 1969, 6th edition (revised.)
3. W. A. J. Chapman, Workshop Technology, Part 1, 2, 3, CBS Publications & Pvt.Ltd, 2001(P1) 2007(P2) 1995(P3) 5th Edition.
4. B. L. Theraja. A. K. Theraja, 1959, Electrical Technology, Volume 3, S Chand, 23rd edition.

Suggested reading

1. R. K. Jain and S. C. Gupta, 2001, Production Technology, Khanna Publishers, 16th edition.
2. 2. S. K. Bhattacharya, 2017, Electrical Machines, McGraw Hill Education, 2017, 4th edition.

Web Resources

1. Digital Number System - Tutorialspoint
2. Number System in Digital Electronics Tutorial - Javatpoint
3. The Mathematics of Boolean Algebra (Stanford Encyclopedia of Philosophy)
4. Boolean Algebra - Tutorialspoint
5. Basic Electronics (rice.edu)
6. Basic Electronics Concepts - Tutorials » Electronics Notes (electronics-notes.com)
7. Basic Electronics Tutorials and Revision (electronics-tutorials.ws)
8. Introduction to Basic Electronics, Electronic Components and Projects (makerspaces.com)
9. Operational Amplifier Basics - Op-amp tutorial (electronics-tutorials.ws)
10. Operational Amplifiers Basics, Characteristics, Types and Applications (elprocus.com)

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Levels
CO1	Identify the different parts of lathe and use it for a specific purpose.	K1, K2
CO2	Classify the tools for cutting, drilling and threading.	K3
CO3	Perform house wiring and troubleshooting.	K4
CO4	Identify suitable measuring devices and tools for making useful objects.	K5
CO5	Construct devices like switch box, tray, pen stand etc.	K6

Course Code	UPH 4501
Course Title	ELECTRONICS – I
Credits	4
Hours/Week	03
Category	MC
Semester	IV
Regulation	2019

Course Overview

1. This course covers the fundamentals of basic electronics.
2. The content includes superposition, Thevenin's and Norton's theorems.
3. The basic operations of FET and BJT are introduced.
4. The ideal and practical parameters of Operational Amplifier and the operation of basic operational amplifier circuits are elaborated.
5. Gives an introduction to the basics of digital integrated circuits design.

Course Objectives

1. To analyse basic simple circuits using network theorems.
2. To discuss biasing of transistor and the application of transistor as amplifiers and oscillators.
3. To illustrate the characteristics of an operational amplifier along with its applications.
4. To prepare students to perform the analysis and design of various digital electronic circuits.
5. To bring out the different issues related to the development of digital integrated circuits including fabrication, circuit design, implementation methodologies, testing, design methodologies tools and future trends.

Prerequisites	Basic knowledge on Higher Secondary Physics

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**NETWORK ANALYSIS** DC circuits – Voltage and current sources – Transformations – Maximum power transfer theorem – Superposition, Thevenin and Norton's theorems.	8		
II	**AMPLIFIERS AND OSCILLATORS** Single stage amplifier – DC load line – Operating point stability – Introduction to biasing – Voltage divider biasing – Multi stage amplifier, RC and direct coupled amplifiers – Feedback requirements for oscillators – Colpitt's oscillator and Wien Bridge oscillators – Multivibrators – Astable, Monostable,Bistable.	9		

III	**OPERATIONAL AMPLIFIER AND SPECIAL DEVICES** Ideal operational amplifier parameters – CMRR – virtual ground – inverting, non – inverting, summing and difference amplifiers – Solving simultaneous equations – FET, MOSFET – Structure, working and V-I characteristics.	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**REGISTERS AND COUNTERS** Registers – Shift registers (4-bit right, left) – Counters – Binary ripple counter (4- bit up counter, 4- bit down counter, 4- bit up/down counter) – Modulus counter (mod-2,4,8) – Decade counter.	8		
V	**INTEGRATED CIRCUIT TECHNOLOGY** Scale of integration – VLSI – Monolithic, thick,thin film and hybrid integrated circuits – Bipolar and MOS technology comparison – Fabrication of monolithic I.C. – fabrication of integrated components like resistors, capacitors, transistors and diodes – Linear and nonlinear I.Cs.	5		

Text Books

1. B. L. Theraja, 2016, Basic Electronics (Solid State), S. Chand & Co., 5th edition.
2. V.K. Mehtha, 2010, Principles of Electronics, S. Chand& Co., 11th edition.
3. Millman J. and Halkias, 2009, Integrated Electronics, Analog & Digital Circuits and systems, Tata McGraw – Hill, 2nd edition.
4. Chattopadhay D. and Rakshit, Electronics Fundamental and applications, New age publishers, 11th edition.
5. A.P Malvino, D.P. Leach, Gautam Saha, 2011, Digital Principles and Applications, Tata McGraw Hill Education, 11th edition.

Suggested Readings

1. John D. Ryder, 2009, Electronic, fundamentals and applications, Prentice Hall, 5th edition.
2. Ben G. Streetman, Sanjay Banerjee, 2009, Solid State Electronic Devices, PHI Learning, 6th edition.
3. Michael D. Ciletti, 2008, Digital Design, M. Morris Mano, Pearson, 4th edition.
4. Virendra Kumar, 1996, Digital technology Principles and practices, New Age Intl., 1st edition.

Web Resources

1. https://nptelvideos.com/lecture.php?id=9125
2. https://nptelvideos.com/lecture.php?id=9116
3. https://nptelvideos.com/lecture.php?id=958
4. https://nptelvideos.com/lecture.php?id=987
5. https://nptelvideos.com/lecture.php?id=974
6. https://nptelvideos.com/lecture.php?id=975
7. https://nptelvideos.com/lecture.php?id=978
8. https://nptelvideos.com/lecture.php?id=9348
9. https://nptelvideos.com/lecture.php?id=9347

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Levels
CO1	Understand the construction of various electronic circuits and different types of fabrication of integrated circuits and electrical components such as resistor, capacitor, transistor and diode.	K1, K2
CO2	Demonstrate the basic concept behind the working process of transistor amplifier, oscillators, multivibrators, registers and counters.	K3
CO3	Perform the mathematical operation like summing, difference and solving simultaneous equations by constructing circuit using operational amplifier.	K4
CO4	Justify to design circuits using transistors, and construct registers and counters employing flipflops	K5
CO5	Solve complex circuits using network analysis	K6

Course Code	UPH 4502
Course Title	PHYSICS PRACTICAL – IV
Credits	03
Hours/Week	03
Category	Major Core (MC) – Practical
Semester	IV
Regulation	2019

Course Overview

1. The aim of the course is to provide the required knowledge in the scientific measurement methods.
2. This course aims to help in estimating various physical properties such as the mechanical properties, electric magnetic properties and optical properties of different materials using scientific apparatus.
3. This course provides information about the basic functions of an operational amplifier.

Course Objectives

1. Estimate the radius of curvature of the given convex lens and hence find the refractive index by forming Newton's rings.
2. Design inverting and non – inverting amplifiers and analyze their operation.
3. Evaluate the thermal conductivity of a bad conductor using Lee's disc apparatus.
4. Compare the capacitance of capacitors using B.G.
5. Verify the parallel axes theorem using Bifilar pendulum.

Prerequisites	Basic knowledge on usage of scientific apparatus

SYLLABUS

S.No	List of experiments	Hours Per week	COs	Cognitive levels
1	Newton's rings – Refractive index of the material of the convex lens.	3	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
2	Liquid lens – refractive index of the given liquid.			
3	Op – amp (IC741) – Inverting and non – inverting amplifier.			
4	Lee's disc – Thermal conductivity of a bad conductor			
5	B.G – comparison of capacitance of capacitors.			

6	Field along the axis of a circular coil – Determination of B_H.			
7	Bifilar pendulum – Determination of 'g' and moment of Inertia.			
8	Spectrometer – i- d curve – refractive index of glass.			

Text Books

1. Anchal Srinivasa & R.K. Shukla, 2018, Practical Physics, New age International Publishers, 2nd edition.
2. C.C. Ouseph & V. Srinivasan, 1990, A text book of Physics Practical – Part I, S. Viswanathan Publishers, 1st edition.
3. C.C. Ouseph & G. Ranga Rajan, 1996, A text book of Physics Practical – Part II, S. Viswanathan Publishers, 1st edition.
4. S.L. Gupta & V. Kumar, 1999 Practical Physics, Pragati Prakashan-Meerut, 23rd edition.

Suggested Readings

1. S.P. Singh, 2000, Advanced Practical Physics II, Pragati Prakashan – Meerut, 12th edition.
2. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan-Meerut Burke, 23rd edition.
3. M. Nelkon & J.M. Ogborn, 1967, Advanced level Practical Physics, Heinemann Educational Books. Ltd-London, 3rd edition.
4. H.S. Aller & H. Moore, 1941, A textbook of Practical Physics, Macmillan and Co & Limited, 5th edition.

Web Resources

1. https://vlab.amrita.edu/?sub=1&brch=189&sim=1520&cnt=1
2. https://rb.gy/38yady
3. https://vlab.amrita.edu/?sub=1&brch=194&sim=353&cnt=1
4. https://vlab.amrita.edu/?sub=1&brch=192&sim=972&cnt=2
5. https://rb.gy/wuzwx6
6. https://vlab.amrita.edu/?sub=1&brch=281&sim=1515&cnt=2
7. http://amrita.olabs.edu.in/?sub=1&brch=6&sim=247&cnt=2
8. https://vlab.amrita.edu/?sub=1&brch=281&sim=1515&cnt=2

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Levels
CO1	Define the aim of the experiment and explain the various parameters in the formula that is used to estimate the physical properties of materials. Identify the equipment and get the accessories.	K1, K2
CO2	Arrange and assemble the gadgets and carryout the experiment.	K3
CO3	List the observations and repeat the experiment to find averages and hence determine the physical quantity by making use of the required formula	K4
CO4	Interpret and report the result and classify the materials based on the measurement. (or)Verify given law. Sketch the variations wherever required.	K5
CO5	Analyze the results of the experiment with an aim to construct or design an equipment or a device for use in project work/research work	K6

Course Code	UPH 4601
Course Title	ASTRONOMY AND ASTROPHYSICS
Credits	06
Hours/Week	06
Category	MAJOR ELECTIVE(ME) - Theory
Semester	IV
Regulation	2019

Course Overview

1. Astronomy is one of the interesting and oldest subjects in Physics. This course is intended to give basic overview of from old to present day developments in the field of Astronomy. First unit deals with basics of observational astronomy, coordinate systems, seasons and calendar system.
2. This unit discusses in detail the various types of telescopes, limitations and basic construction of CCD.
3. This unit deals with stellar parallax, distance measurements, light year, parsec. It also describes the apparent, absolute magnitude systems for stars.
4. This unit deals with formation of star, various types of binary stars and HR diagram.
5. This unit discusses the basics of Galaxies, properties of Milky way galaxy, Hubble's law and Redshift, Blue shift.

Course Objectives

1. To understand basic terminologies, Coordinate systems, diurnal motions of stars, sun.
2. To understand about different types of telescope and enable the students to handle a telescope.
3. To understand the stellar parallax and absolute, apparent magnitude system and apply this knowledge in the night sky observation.
4. To enable the students to classify various types of binary stars and comprehend the formation of stars.
5. To understand and explain the overview of galaxies, Hubble's law, red and blue shift of stars.

Prerequisites	1. Basic knowledge of higher secondary level Physics 2. Basic knowledge of higher secondary level mathematics and electronics

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**ASTRONOMICAL TECHNIQUES** Celestial sphere, Coordinate systems (basics), Diurnal motion of the sun and stars – Sidereal day – Sidereal time, zones and seasons of earth – Equinoxes and solstices – Variations in the durations of day and night during the year – Time	18		

	(GMT, JD)		CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**OBSERVATIONS AND INSTRUMENTS** Observing through the Atmosphere – Different wavelength regions – Optical telescopes (Refracted and Reflected) – Mounting systems (alt – azimuth – equatorial) – Angular resolution – Magnification – Detectors and Instruments – CCD camera – Working principle.	18		
III	**PHOTOMETRIC CONCEPTS AND MAGNITUDES** Stellar distances – Trigonometric parallax – Intensity – Flux density and luminosity – Apparent magnitudes – Magnitude systems – Absolute Magnitudes – Extinction and optical thickness.	18		
IV	**CLASSIFICATION OF STARS** Life – Cycle of the stars – The black body model of a star – Spectral classification of stars – Stellar colours – Colour index – Hertzsprung – Russell diagram – Visual binaries – Astrometric binary stars – Spectroscopic binaries – Photometric binary stars	18		
V	**GALAXIES AND COSMOLOGY** Observable universe – Classification of galaxies based on Hubble sequence – Properties of each matter in galaxies – Red – shifts and Blue – Shifts – Hubble's law in relation to the expanding universe.	18		

Text Books

1. Karttunen, Fundamental Astronomy, 2006, Springer Publication, 5th edition.
2. Marc. L Kutner, 2007, Astronomy: A physical perspective, Cambridge University Press,2nd edition.

Suggested Readings

1. Dinah L. Moché, 2009, Astronomy – A Self Teaching Guide, John Wiley & Sons, Inc., 7th edition.
2. Steve B. Howell, 2006, Handbook of CCD Astronomy, Cambridge University Press,1st edition.
3. Mark H. Jones, Robert J. A. Lambourne, Stephen Serjeant, 2015, An Introduction to Galaxies and Cosmology, Cambridge University Press, 2nd edition.

Web Resources

1. https://rb.gy/v5qhej
2. https://rb.gy/lmtewe
3. https://rb.gy/o29qwo
4. https://www.youtube.com/watch?v=vKAd2ICBk2c
5. https://rb.gy/36dvck

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO DESCRIPTION	Cognitive Levels
CO1	Understand the fundamentals of astrophysics	K1, K2
CO2	Apply the knowledge of coordinate system to positional astronomy	K3
CO3	Compare various the new techniques and methods used astronomy.	K4
CO4	Summarize the properties and evolution of different types of stars, galaxies	K5
CO5	Design and construct telescopes and write how old and recent techniques modified the astrophysics field	K6

Course Code	UPH 4602
Course Title	INTRODUCTORY NANO SCIENCE & NANO TECHNOLOGY
Credits	06
Hours/Week	06
Category	Major Elective (ME)- Theory
Semester	IV
Regulation	2019

Course Overview

1. Nanoscience is an interdisciplinary subject integrating the fields of Physics, Chemistry and Biology.
2. The aim of the course is to give basic knowledge about the nanomaterials and its properties.
3. The various modules of the course will examine different methods of preparation of nanoparticles including top-down and bottom-up approach, its benefits and limitations.
4. In this course we will also examine the characterization techniques for structural and optical properties of nanomaterials.
5. The other most important aspect-application of this course includes :Bio-imaging and Nano robots used in diagnosis and therapy -optoelectronic devices and catalysis.

Course Objectives

1. To understand the basics of nanoscale systems and industry revolution by Nanotechnology.
2. To understand the classification of 0D/1D/2D/3D nanostructures with examples.
3. To understand the size and shape of nanostructures and comparison to micro structures.
4. To apply the knowledge of nanomaterials properties to its effective Engineered applications.

Prerequisites	Basic knowledge on Physics (or) Materials science.

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY** Introduction – Nanoscience and nanotechnology – Length, energy, and time scale of nanoscale systems – Classification – Nanoparticles – nanoclusters – 0D nanostructures (quantum dots) – 1 D, 2D and 3D nanostructures – NANO – revolutionize the world.	15	CO1,	

II	**PROPERTIES OF NANOMATERIALS** Introduction – Size and shape effect – surface area and aspect ratio – band gap energy – Mechanical properties – Elastic behaviour; Hardness and strength – Electrical properties – Quantum transport – Dielectric properties – Optical properties of nanoparticles – Surface plasmon resonance (SPR) – Quantum size effects.	15	CO2, CO3, CO4, CO5	K1,K2,K3,K4,K5, K6
III	**SYNTHESIS OF NANOMATERIALS** Introduction – Bottom up approach – wet chemical methods – solvothermal/hydrothermal methods – Sol gel process – Top down – Ball milling – Physical vapour deposition – Laser ablation – chemical vapour deposition – Molecular beam epitaxy.	15		
IV	**CHARACTERIZATION TECHNIQUES** X – Ray diffraction (XRD) – Crystallite size – Scherrer formula – UV spectroscopy – Band gap – Blue shift and red shift – Field emission scanning electron microscopy (FESEM) – Transmission electron microscopy (TEM) – Scanning tunnelling microscopy (STM) – Atomic force microscopy (AFM).	15		
V	**APPLICATIONS OF NANOTECHNOLOGY** Introduction– Nanomaterials in medicine – Drug delivery system – Cellular imaging – Nano – robots for diagnostics and therapy – Nanomaterials in energy sector – High energy density batteries – Solar photovoltaic cells – Photo-degradation – Bioremediation.	15		

Text Books

1. G.Timp, 1999, Nanotechnology AIP press, Springer – Verlag. New York, 2nd edition.
2. Charles Poole, 2003, Introduction to nanotechnology, Wiley Inter science Publication, 4th edition.
3. M.A.Shah, Tooker Ahmad, 2010, Principles of Nanoscience and Nanotechnology, Narosa Publishing House, 2nd edition.
4. B S Murthy, P Shankar, Baldev Raj, B B Rath and James Murday, 2012, Textbook of Nanoscience and Nanotechnology by,-University Press. 3rd edition.
5. Thomas Varghese, K.M. Balakrishna, 2012, Nanotechnology Atlantic Publishers and Distributors, 2nd edition.

Suggested Readings

1. A.S Edelstein, 1996, Nanomaterials Synthesis properties and application IOP Publishing, UK, 2nd edition.
2. Hari Singh Nalwa, 2000, Handbook of Nanostructured Materials and Technology, Academic Press, USA, 1st edition.
3. Shubra Singh M.S. Ramachandra Rao, 2013, Nanoscience and Nanotechnology: Fundamentals of Frontiers, Wiley, 1st edition.
4. Asim. K. Das, Mahua K. Das, 2020, An Introduction To Nanomaterials And Nanoscience, 1st edition.
5. T. Pradeep, 2013, A Textbook of Nanoscience and Nanotechnology, Wisdom press, 1st edition.

Web Resources

1. https://en.wikipedia.org/wiki/Nanotechnology
2. https://ec.europa.eu/jrc/en/research-topic/nanotechnology
3. http://www.hse.gov.uk/nanotechnology/
4. https://www.nano.gov/nanotech-101/
5. http://www.crnano.org/whatis.htm
6. http://www.nnci.net
7. https://ec.europa.eu/programmes/horizon2020/en/h2020-section/nanotechnologies
8. http://www.research.ibm.com/pics/nanotech/defined.shtml
9. https://www.nsf.gov/crssprgm/nano/

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Levels
CO1	To understand and recall the crystal system and Unit cell parameters.	K1, K2
CO2	To Integrate and assess the chemical and physical properties of materials into nanoscale dimension.	K3
CO3	To analyze and differentiate micro and nano structured materials based on Mechanical, Electrical, Optical and Dielectric properties.	K4
CO4	To explain the synthesis of nanoparticles through simple, facile and cost-effective approach.	K5
CO5	To simulate the role of nanomaterials in medicine for diagnosis, Energy conversion and photo-degradation.	K6

Course Code	UPH 4603
Course Title	GEOPHYSICS
Credits	06
Hours/Week	06
Category	Major Elective (ME)– Theory
Semester	IV
Regulation	2019

Course Overview

1. Geophysics is an interdisciplinary subject applied in wide range of industries, including petroleum and mineral exploration, groundwater, contaminants and salinity evaluation, state and government geological surveys, defense science and academic research.
2. The aim of this course is to provide the background knowledge in solid-earth, exploration and environmental Geophysics. It is split into five sections: (i) Physics of Earth (ii) Geophysical and Geochemical analysis (iii) Seismology (iv)Geomagnetism and gravity (v) Geochronology and Geothermal Physics
3. In each section, we start with the underlying mathematical basis and examine applications at global, exploration and environmental scales.
4. The course also involves methods of geophysical data analysis, modelling, visualization and interpretation through IPI2WIN and ArcGIS software.
5. Students will have their career options through industry visits at Indian Meteorological Department (IMD), Chennai. The course is aimed at students from a range of numerate scientific backgrounds including geoscience, Physics, engineering, mathematics and computer sciences to choose their career and higher studies in Geophysics.

Course Objectives

1. To understand the structures and purposes of basic structure of Earth.
2. To understand the formation of Earth through geophysical methods and analysing Geochemistry of groundwater.
3. To understand the geomagnetic behavior and gravity phenomenon of the Earth.
4. To apply the knowledge of Physics to evaluate the geophysical structures of Earth using various physical properties.

Prerequisites	Basic knowledge on Physics and Geophysics

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**PHYSICS OF THE EARTH** Introduction to Geophysics – Earth as a member of the solar system – Atmosphere – Ionosphere – Asthenosphere – Lithosphere – Hydrosphere and Biosphere – Meteorology – Oceanography andHydrology.	18	CO1, CO2, CO3, CO4, CO5	K1,K2,K3,K4,K5,K6
II	**GEOPHYSICAL AND GEOCHEMICAL METHODS** Geophysical methods: Geo referencing using Arc GIS software. Electrical methods – Quantitative interpretation of Vertical Electrical Sounding curves –Preparing pseudo cross section for electrical resistivity data and interpretation. Geochemical methods: Introduction – Principles of groundwater chemistry – Sources of contamination – Ground water quality analysis using geochemical methods.	18		
III	**INTRODUCTION TO SEISMOLOGY** The earth's interior and crust as revealed by earthquakes – Rayleigh waves and Love waves – Elastic rebound theory – Continental drift – Earthquake magnitude and intensity – Horizontal seismograph and seismograph equation – Tsunami – Causes and Impacts – Tsunami warning systems.	18		
IV	**GEOMAGNETISM AND GRAVITY** Historical introduction –The physical origin of magnetism – Causes of the main field – Dynamo theory of earth's magnetism. Gravitational potential – Laplace's equation and Poisson's equation – Absolute and relative measurements of gravity – Worden gravimeter.	18		
V	**GEOCHRONOLOGY AND GEOTHERMAL PHYSICS** Radioactivity of the earth – Radioactive dating of rocks and minerals – Geological time scale – The age of the earth. Flow of heat to the surface of the earth –Sources of heat within the earth – Process and heat transport and internal temperature of	18		

	earth.			

Text Books

1. Arthur W. Hounslow, 1995, Water quality data -Analysis and Interpretation, Lewis Publishers, Washington D.C.,11th Edition.
2. Cook. A.H., 1973, Physics of the Earth and Planets, McMillan Press, London, 4th Edition
3. John Milsom, 2011, Field Geophysics-The geophysical field guide, Wiley publications, England, 3rd edition.
4. Krauskopf. K. B., 1967, Introduction to Geochemistry. McGraw Hill.,6th Edition.
5. Ramachandra Rao (1975) Outline of geophysical prospecting-a manual for geologists University of Mysore, 5th Edition.

Suggested Reading

1. George. G. Garland, 1979, Introduction to Geophysics, WB Saunder Company, London,5th edition.
2. William Lowrie, 1984, Fundamentals of Geophysics, Cambridge press, UK, 11th edition.
3. Nils-Axel Morne, 1989, Geochronology- Methods and case studies. INTECH publications 5th edition.
4. John Raferty, 2011, Geochronology –Dating and Precambrian time –The beginning of the world as we know it Britannica Educational publishers, New York, 7th edition.
5. Don L.Anderson, 1989, Theory of the Earth, Blackwell scientific Publications-,UK, 6th edition.

Web Resources

1. https://sites.ualberta.ca/~vadim/Geoph325/Course325.htm
2. INTERMAGNET
3. IMD | Home
4. GeoPhysics | USGS.gov
5. Signal Analysis and Imaging Group - SeismicLab - Matlab Scripts for Seismic Data Processing
6. CSIR - National Geophysical Research Institute (ngri.org.in)
7. PGDA - Home (nasa.gov)

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Levels
CO1	Discuss the Physics and geology of the earth through geophysical observation and measurements.	K1, K2
CO2	Comprehend the broad scale structure of the Earth and the physical processes governing the Earth's interior	K3
CO3	Empower students to understand the principles of applying geophysical methods to socially relevant problems, including natural hazards, ground water resource management and other environmental issues.	K4
CO4	Create the ability to interpret the data obtained from the geoelectrical, geochemical, magnetic and seismic methods.	K5
CO5	Investigate the models and by solving the equations with the use of both analytical and computational methods.	K6

Course Code	UPH 4401
Course Title	APPLIED PHYSICS
Credits	02
Hours/Week	04
Category	Allied Optional (AO) – Theory
Semester	IV
Regulation	2019

Course Overview

1. This course provides broad view on the application of Physics to identify and solve scientific or Engineering problems.
2. The semiconductor devices, logic gates and their applications in opto-electronics and photonics are discussed.
3. This course provides fundamental concepts of physical sciences for utilization of scientific principles in designing the circuits.
4. various types of Lasers and their practical applications are explained in detail.

Course Objectives

1. To understand the principles and properties of semiconductors and their applications in opto-electronic devices.
2. To understand the principles and working of logic gates.
3. To comprehend how amplifiers are utilized for fundamental scientific operations.
4. To analyze characteristics of devices and electronic circuits.
5. To apply the concepts and construct electronic circuits and devices.

Prerequisites	Fundamental knowledge in Physics and Electronics

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**SEMICONDUCTOR DEVICES** Semiconductors – Intrinsic and extrinsic semiconductor – PN junction diode – Forwardand reverse biasing of a junction diode – V-Icharacteristics of a junction diode – Zener diode.	9	CO1, CO2, CO3, CO4,	K1, K2, K3, K4, K5, K6
II	**OPTOELECTRONIC DEVICES** Principles – Operation and characteristics of opto-electronic devices: LDR – Photo diode – Photo transistor – Photo voltaic cell – Solar cell – Photo	9		

	emissive sensors – LED – IR emitter – LCD – Opto-couplers.		CO5	
III	**NUMBER SYSTEM AND LOGIC GATES** Binary, octal, decimal and hexadecimal number system – Conversion from one number system to another – Boolean algebra – De Morgan's theorems – Basic logic gatesusing IC components – NAND & NOR as universal gates.	9		
IV	**OPERATIONAL AMPLIFIERS** Ideal Op-amp – Inverting and non-inverting amplifiers – Unity follower – Summing amplifier – Difference amplifier – Integrator – Differentiator.	9		
V	**FUNDAMENTALS OF LASER** Characteristics of laser – spontaneous and stimulated emission of radiation – Nd:YAG laser – He-Ne laser – carbon dioxide and, Nd-YAG lasers, Semiconductor diodelaser – applications of lasers.	9		

Text Books

1. Ghatak A.K. and Thyagarajan K., 2011, Lasers and Fundamentals, Macmillan, 2nd Edition.
2. Vijayendran V., 2009, Introduction to Integrated Electronics, Viswanathan S., Printers & Publishers Pvt. Ltd., 1st edition.
3. Mehta V.K., Rohit M., 2010, Principles of Electronics, Viswanathan S., Printers & Publishers Pvt. Ltd., 11th Edition.
4. Chattopadhay D and Rakshit, 2010, Electronics Fundamental and applications, New Age International, 11th edition.
5. Gayakward R.A., 2009, Op-Amps and Linear Integrated circuits, PHI Learning, 4th Edition.

Suggested Readings

1. Gupta S.L., Kumar V., 2012, Handbook of Electronics, Pragati Prakashan, 23rd edition.
2. Jain R.P., 2009, Modern Digital Electronics, Tata McGraw – Hill Education, 4th Edition.
3. Gordon J.D., Clifford N.B., 1978, Integrated Circuits and Semiconductor Devices: Theory and applications, McGraw – Hill Education, 2nd Edition.

Web Resources

1. https://nptelvideos.com/lecture.php?id=9125
2. https://nptelvideos.com/lecture.php?id=9116
3. https://nptelvideos.com/lecture.php?id=958
4. https://nptelvideos.com/lecture.php?id=987
5. https://nptelvideos.com/lecture.php?id=974

Course Outcomes (COs) and Cognitive Level Mapping

Cos	CO Description	Cognitive Levels
CO1	Apply the principles of non-linear optics in different industries	K1, K2
CO2	Analyze logic circuits and their applications	K3
CO3	Design and construct simple electronic devices	K4
CO4	Use different Number systems in the field of computers	K5
CO5	Apply the concepts of digital electronics to the real-world situations	K6

Course Code	UPH 4402
Course Title	APPLIED PHYSICS LAB
Credits	01
Hours/Week	02
Category	Allied Optional (AO)-Practical
Semester	IV
Regulation	2019

Course Overview

1. This course discusses the basics of Electronics and hands–on – experience on measurements through experiments.
2. The course enables the learners to study the characteristics and the use of electronic components like Transistor, operational amplifier and other ICs.
3. The objective of the course is to provide the opportunity to learn, design and construct circuits.

Course Objectives

1. To Construct of Amplifier circuits using Opamp
2. To construct a circuit diagram for light to frequency converter using 555 timer.
3. To verify the output voltage of summing and difference amplifier using Opamp.
4. To design temperature to voltage converter using Op – Amp.
5. To design a circuit for inverting and non – inverting amplifier using Opamp

Prerequisites	Basic knowledge on usage of electronic apparatus

SYLLABUS

S.No	List of experiments	Hours Per week	COs	Cognitivelevels
1	Basic Logic gates – AND, OR,NOT	2	CO1, CO2, CO3,	K1,K2,K3,K4,K5,K6
2	NAND & NOR – Universal gates			
3	Inverting Amplifier, Non inverting amplifier Op Amp			
4	Non inverting amplifier – Op Amp			
5	Summing amplifier – Op Amp			

6	Difference amplifier – Op Amp		CO4, CO5	
7	Light to frequency converter – 555 Timer			
8	Temperature to voltage converter using Op – Amp			

Text Books

1. Ian Sinclair, John Dunton, 2018, Practical Electronics Handbook, Elsevier Publishers, 6th edition.
2. C.C. Ouseph & V. Srinivasan, 1990, A text book of Physics Practical – Part I, S. ViswanathanPublishers, 1st edition.
3. C.C. Ouseph & G. RangaRajan, 1996, A text book of Physics Practical – Part II, S.Viswanathan Publishers, 1st edition.
4. Paul Scherz, Simon Monk, 2016, Practical electronics for inventors, Mc Graw Hill Education, 4th edition.
5. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan-Meerut, 23rd edition.

Suggested Readings

1. John M. Huges, 2015, Practical Electronics, Schroff O'Reilly, 1st edition.
2. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan-Meerut Burke, 23rd edition.
3. M. Nelkon & J.M. Ogborn, 1967, Advanced level Practical Physics, Heinemann Educational Books. Ltd-London, 3rd edition.
4. M. Nelkon & J.M. Ogborn, 1941, A textbook of Practical Physics, Macmillan and Co &Limited, 4th edition.
5. Indu Prakash & Ramakrishna, A Text Book of Practical Physics, Kitab Mahal, 3rd edition.
6. Nelkon and Ogborn, 1978, Advanced level Practical Physics, Heinemann Edu. Publ., 4th edition.
7. D. Chattopadhyay & P. C Rakshit, 2011, An Advanced Course in Practical Physics, New Central Book Agency, 10th edition.

Web Resources

1. https://rb.gy/1pdr2o
2. https://rb.gy/qjftkl

Course Outcomes (COs) and Cognitive Level Mapping

Cos	CO DESCRIPTION	Cognitive Levels
CO1	Demonstrate NAND & NOR as Universal Building blocks	K1, K2
CO2	Analyze the voltages of inverting and non-inverting amplifier using Op- Amp	K3
CO3	Identify the output voltages of a summing and difference amplifier using Op- Amp	K4
CO4	Construct a circuit diagram for light to frequency converter using 555 timer	K5
CO5	Construct and determine the frequency of an Astable multivibrator	K6

Course Code	UPH 4801
Course Title	ELECTRONIC GADGETS
Credits	02
Hours/Week	03
Category	Non Major Elective (NME)
Semester	IV
Regulation	2019

Course Overview

1. This course deals with the importance of electronic gadgets of in our day-to-day life.
2. Working and applications of the electronic gadgets are discussed in detail.
3. This course provides a basic knowledge on energy storage devices.
4. The hardware components of the computers will be explained.
5. This course focuses on imparting technical skills to students.

Course Objectives

1. To understand the fundamentals and functions of electronic components and design of acomputers
2. To understand common communication systems.
3. To understand the impact of energy storage devices in a global, economic, and societalcontext.
4. To understand the principles and working of Medical Appliances.
5. To apply the knowledge to Install and troubleshoot the home appliances

Prerequisites	Basic knowledge on Physics, Electronics, communication systems

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVELEVEL
I	**Computer** Basic components – Motherboard– Processors– RAM/ROM – Hard disk – I/O devices – Operating systems.	7	CO1, CO2, CO3, CO4, CO5	K1,K2,K3,K4,K5,K6
II	**Communication Devices** Smart phones – Phone jammers – Bluetooth – Wi – Fi – Global Positioning System (GPS) – RFID security systems.	7		

III	**Energy storage Devices** Primary cells – AA & AAA batteries –Secondary batteries – Lithium – ion battery –Solid state batteries – Inverters.	7		
IV	**Medical Appliances** Digital weighing machine – Digital thermometer – Digital BP device – Digital ECG device – Digital self – monitoring of blood glucose (SMBG)device.	6		
V	**Home Appliances** Air conditioner – Refrigerator – Microwave oven – Induction cooker – Washing machine – Solar Powered appliances – Smart television.	6		

Text Books

1. Gottapu Sasibhushana Rao, 2012, Mobile Cellular Communication, Pearson.1st edition.
2. Alok Kumar, 2008, Computer General Awareness, Upkar Prakashan 1st edition.
3. Eric Kleinert, 1995, Troubleshooting and Repairing Major Appliances, McGraw Hill Education, 3rd edition.

Suggested Readings

1. William Stallings, 2006, Data and computer communications, Pearson Prentice Hall, 8th edition.

Web Resources

1. https://en.wikipedia.org/
2. https://www.idealenergysolar.com/
3. http://www.chseodisha.nic.in/
4. https://old.amu.ac.in/
5. https://www.khanacademy.org/
6. www.scienceabc.com/

Course Outcomes (COs) and Cognitive Level Mapping

Cos	CO Description	Cognitive Levels
CO1	Identify the functions of Electronic components and their faults.	K1, K2
CO2	Compare the different communication systems and identify the advantage of one over the other.	K3
CO3	Compare the various types of batteries based on construction and use.	K4
CO4	Analyse the working of Medical Appliances.	K5
CO5	Install and troubleshoot home appliances.	K6

Course Code	UPH 5501
Course Title	QUANTUM MECHANICS
Credits	06
Hours/Week	06
Category	Major Core (MC) – Theory
Semester	V
Regulation	2019

Course Overview

1. The birth of quantum mechanics is introduced in a very logical sequence starting from the failure of classical mechanics. The notion of quanta is brought in along with its inevitable consequence of wave particle duality.
2. The fundamental tools required for the effective dissemination of the concepts are introduced before introducing Schrodinger wave equation.
3. Formulation of some of the simplest 1-dimensional problems and their solutions using Schrodinger wave equation demonstrates the techniques involved in quantum mechanics.
4. The important concept of quantization of angular momentum and the Dirac's notation are introduced leading up to a discussion of spin angular momentum.
5. Generalization of 1D to 3D problems is included.

Course Objectives

1. To point out how classical mechanics failed to explain phenomena such as black body radiation and photoelectric effect and to lay a strong logical argument for the introduction of a new approach to understanding the physical world (i.e) the concept of quanta and its consequences in themicroscopic world.
2. To familiarize the students to the new mathematical tools such as operators and linear vector space required for venturing into the realm of quantum mechanics and to introduce Schrodinger wave equation.
3. To demonstrate the use of Schrodinger wave equation through some simple one-dimensional problems and their solutions. To discuss the quantum features of the new method which are absent in the classical method.
4. To analytically and algebraically treat the orbital angular momentum problem, to bring out its quantum nature and to port it to have a theory of spin angular momentum.
5. To generalize the one-dimensional problems to three dimensional ones to broaden the horizon of the students leading to the understanding of the concept of degeneracy. To solve hydrogen atom problem to explain atomic spectrum.

Prerequisites	1. A thorough understanding of mechanics. 2. Knowledge of partial differential equation and variable separable method. 3. Commendable knowledge of integral and differential calculus.

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**EMERGENCE OF QUANTUM MECHANICS** Failure of classical mechanics: black body radiation, photoelectric effect, Compton effect, De Broglie hypothesis, experimental confirmation (Davisson – Germer experiment and GP Thompson experiment) Wave – particle duality, Heisenberg's uncertainty principle, application of uncertainty relations (Non – existence of free electrons in the nucleus, Ground state of hydrogen atom andradius of Bohr orbit, strength of nuclear force), Bohr's correspondence principle.	20	CO1, CO2, CO3, CO4, CO5	K1,K2,K3,K4,K5,K6
II	**FOUNDATION OF QUANTUM MECHANICS** Schrodinger wave equation, wave function: admissibility conditions – Probability interpretation, probability current density and equation of continuity Ehrenfest theorem – Time independent Schrodinger wave equation, stationary states – Hermitian operator eigenfunctions and eigenvalues – Postulates of Quantum Mechanics, Commutation relations Linear vector space, Dirac's notation	20		
III	**APPLICATION OF SCHRODINGER WAVE EQUATION TO1D** Free particle, wave packets and motion of wave packets – Group velocity and wave velocity – Particle in an infinite potential well – Particle in a finite potential well – Finite potential barrier, tunnelling, barrier penetration and α-decay – Linear harmonic oscillator (series method), energy eigenvalues and eigenfunctions.	15		
IV	**ANGULAR MOMENTUM** Orbital angular momentum – Commutation relations - Eigenfunctions of L_z&L^2, properties of spherical harmonics, matrix representation Spin angular momentum, experimental evidence – Stern &Gerlach experiment – Spin $\frac{1}{2}$ particles, Pauli matrices.	15		
V	**THREE DIMENSIONAL PROBLEMS** In Cartesian coordinates: Free particle, Particle in 3D infinite potential well, degeneracy, harmonic oscillator - In spherical polar coordinates: rigid rotator – Hydrogen atom – energy eigenvalues and eigenfunctions.	20		

Text Books

1. S.L. Kakani& H.M. Chandalia, 2004, Quantum Mechanics: Theory and problems, Sultan Chand & sons, 4th edition.
2. Nouredine Zettili, 2009, Quantum Mechanics – concepts & applications, Wiley, 2nd edition.
3. David Griffiths, 2015, Introduction to Quantum Mechanics, Pearson, 2nd edition.

Suggested Readings

1. PM Mathews & K Venkatesan, 2011, A Text book of Quantum Mechanics, Tata Mc Graw Hill Education, 2nd edition.
2. Walter Greiner, 1997, Quantum Mechanics – An introduction, Springer, 4th edition.
3. Eyvind H Wichman, 1971, Quantum Physics (Berkeley series), , Tata McGraw Hill Education, 1st edition.
4. Richard P Feynman, Robert B Leighton & Matthew Sands, 2012, The Feynman Lecturers on Physics, Pearson, Volume 3, The new millennium edition.
5. G. Aruldhas, 2013, Quantum Mechanics, , Prentice Hall of India, 2nd edition.
6. Arthur Beiser, Shobit Mahajan, S Rai Choudhury, 2017, Concepts of Modern Physics, 7th edition.

Web Resources

1. https://onlinecourses.nptel.ac.in/noc20_cy27/preview
2. https://nptel.ac.in/courses/115/101/115101107/
3. https://nptel.ac.in/courses/115/102/115102023/
4. https://www.azoquantum.com/video-details.aspx?VidID=9
5. https://nptel.ac.in/courses/115/106/115106066/
6. http://www.iiserpune.ac.in/~sdube/phy202/threeD.pdf

Course Outcomes (COs) and Cognitive Level Mapping

Cos	CO DESCRIPTION	Cognitive Levels
CO1	Explore the context of development of quantum mechanics and the dual nature of physical world and importance of Schrodinger wave equation to solve problems using uncertainty principle and operator algebra.	K1, K2
CO2	Classify operators as linear, Hermitian and non-Hermitian and physical systems as completely solvable and approximately solvable. Apply operator algebra and Dirac's bracket notation to construct the quantum picture of orbital angular momentum	K3
CO3	Set up and solve Schrodinger wave equation for one dimensional problems and identify the quantum features such as discreteness of the observables of the systems. Compare and contrast the results with classical counterpart. Estimate the magnitudes of some atomic scale data	K4
CO4	Modify orbital angular momentum formalism to suit spin angular momentum observations. Evaluate various commutation relations among Hermitian operators and choose the basis vectors for a linear vector space.	K5
CO5	Assess the degeneracy of quantum states. Formulate the hydrogen atom problem and categorize the quantum numbers and the associated orbitals. Summarize the properties of a linear vector spaces.	K6

Course Code	UPH 5502
Course Title	THERMAL PHYSICS
Credits	06
Hours/Week	06
Category	Major Core (MC) – Theory
Semester	V
Regulation	2019

Course Overview

1. Kinetic theory of gases provides insights on behaviour of molecules in ideal and real gases.
2. Maxwell's distribution of velocity puts forward the idea about velocity distribution among the identical, distinguishable particles.
3. This course encompasses the laws of thermodynamics, which talks about how and why heat flows, the types ofheat transfer, phase changes, and the relationship between energy and work.
4. Study of Heat engines provide the means to extract useful work using a combination of cold and hot reservoirs
5. Maxwell's Thermodynamic relations establishes the connection between various thermodynamic quantities (P,V,T&S) and thermodynamic potentials.

Course Objectives

1. To Understand the molecular behaviour of ideal and real gases.
2. To Comprehend various thermodynamic processes involved in the systems.
3. To identify the limitations of First and second law of thermodynamics.
4. To apply the first law of thermodynamics to find various thermodynamics quantities like specific heat capacity etc.
5. To obtain Maxwell's thermodynamic relations involving heat capacities.
6. To understand the phenomenon of equilibrium between phases and derive Clausius – Clapeyron latent heat equation.

Prerequisites	1. A solid understanding of partial derivatives is the key. 2. Ability to expand simple polynomials and trigonometric functions is needed. 3. Basic knowledge of Integration and calculus are essential for this course.

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**KINETIC THEORY OF GASES AND MAXWELLIAN DISTRIBUTION** Introduction – Basic assumptions of kinetic theory – Pressure Exerted by an ideal gas – kinetic interpretation of Temperature – classical theory of	18		

	heat capacities – Distribution of molecular velocities in a perfect gas: Maxwell – Boltzmann distribution law – Maxwell's distribution of molecular speeds – Average speed, RMS speed, most probable speed, Energy distribution of a Maxwellian gas – Examples		CO1, CO2, CO3, CO4, CO5	K1,K2,K3,K4,K5,K6
II	**MEAN FREE PATH & BASIC CONCEPTS OF THERMODYNAMICS** Mean free path (Zeroth and First order) – Survival equation – Van der Waal's equation of state (Derivation) – Thermodynamic system, surroundings, boundaries – state of a system and thermodynamic variables – Thermodynamic equilibrium – Processes – The Zeroth law and concept of temperature – Some deductions from the equation of state.	16		
III	**LAWS OF THERMODYNAMICS** Introduction – origin of the first law – internal energy – Various interactions: Thermal, mechanical and diffusive – the first law – applications of first law (heat capacities of gas, adiabatic equation of state & adiabatic lapse rate) – Enthalpy: Another form of first law of thermodynamics – the second law and its origin – Kelvin-Planck statement, Clausius statement – Heat engines – Carnot cycle – Carnot's theorem – Thermodynamic Temperature – irreversibility and unavailable energy. Third law of thermodynamics.	20		
IV	**ENTROPY AND THERMODYNAMIC RELATIONS** Introduction – Entropy – Entropy change in reversible processes: Carnot's cycle, Reversible heat transfer – Clausius inequality – Entropy change in an irreversible process – the principle of increase of entropy – Joule's expansion – The entropy form of the first law – Unavailable energy and Thermal death of universe – Physical concept of entropy – Maxwell's relations – thermodynamic relations involving heat capacities – TdS equations – The energy equations.	20		
V	**FREE ENERGIES AND THERMODYNAMIC EQUILIBRIUM** Introduction – General condition for natural change – Adiabatic process, isothermal Process – Free energies and Maxwell's relations –Thermodynamic mnemonic diagrams – General conditions for thermodynamic equilibrium: An adiabatic process, Isothermal process – Equilibrium between phases – First order Phase transition: Clausius – Clapeyron equation.	16		

Text Books

1. S.C. Garg, Bansal, R.M. &Ghosh, C.K., 2017, Thermal Physics, Tata McGraw HillEducation, 2nd edition.

Suggested Readings

1. M W Zemansky & R H Dittman, 2017, Heat and thermodynamics, McGraw Hill Education, 8th edition.
2. F W Sears & G L Salinger, 2013, Thermodynamics, kinetic theory and statistical thermodynamics, Narosa Publishing House, 3rd edition.
3. Daniel V. Schroeder, 2000, An Introduction to Thermal Physics, Addison-Wesley, 1st edition.
4. H. B. Callen, 1985, Thermodynamics, John Wiley & Sons, 2nd edition.
5. Charles Kittel and Herbert Kroemer, 1980, Thermal Physics, W.H Freeman Publication, 2nd edition.

Web Resources

1. https://nptel.ac.in/courses/115/106/115106090/
2. https://nptel.ac.in/courses/115/106/115106090/
3. https://nptel.ac.in/courses/115/106/115106090/
4. https://nptel.ac.in/courses/115/106/115106090/
5. https://nptel.ac.in/courses/115/106/115106090/
6. https://nptel.ac.in/courses/115/106/115106090/
7. https://www.youtube.com/watch?v=1_InUUX5-LE
8. https://www.youtube.com/watch?v=E9cOAMhFUz0
9. https://www.youtube.com/watch?v=qKMsG6WrR0s
10. https://www.youtube.com/watch?v=XooN0w8SDZo
11. https://www.youtube.com/watch?v=4RX_lpoGRBg
12. https://www.youtube.com/watch?v=mb8LqNlHeLY
13. https://www.youtube.com/watch?v=mb8LqNlHeLY
14. https://www.youtube.com/watch?v=kSuXS_zqRec&t=55s
15. https://www.youtube.com/watch?v=N-hWsLSC9Ms
16. https://www.youtube.com/watch?v=WTtxlaeC9PY

Course Outcomes (COs) and Cognitive Level Mapping

Cos	CO Description	Cognitive Levels
CO1	Intrepret the meaning of temperature from the results of the kinetic theory of gases.	K1, K2
CO2	Find the mean free path by suitable approximation method.	K3
CO3	Apply the first and second law of thermodynamics for different problems.	K4
CO4	Calculate the entropy change in reversible and irreversible process.	K5
CO5	Compare adiabatic and isothermal processes in general conditions for thermodynamic equilibrium.To apply the knowledge of thermodynamics for climate change.	K6

Course Code	UPH 5503
Course Title	OPTICS
Credits	06
Hours/Week	06
Category	Major Core (MC) – Theory
Semester	V
Regulation	2019

Course Overview

1. The study of light, transmission of light through matter is not only an important branch of physics, but it is equally interesting. This course intends to give some advanced information about the behavior and properties of light.
2. The matrix method of getting the lens equation and different types of eyepieces will be introduced.
3. Those experiments which bring out the wave nature of light will also be dealt with.
4. A preliminary study of different techniques of producing and detecting polarized light will also form part of this course
1. Fundamentals of Non-linear optics which is a new branch of physics will be discussed

Course Objectives

1. To understand the fundamentals of Optics.
2. To learn the fundamental wave characteristics of light.
3. To understand the working principles of LASERs and their Applications.
1. To apply the knowledge of optics in Modern LASER Technologies.

Prerequisites	Basic knowledge in optics and its applications

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**GEOMETRICAL OPTICS** Matrix method in ray optics–Effect of translation and refraction – Thick and thin lens formulae –Unit planes–Nodal planes– System of two thin lenses. Dispersive power of a prism– combination of prisms to produce –dispersion without deviation – deviation without dispersion – Lens aberrations –monochromatic aberrations – spherical aberration –Coma– astigmatism–curvature of the field– distortion– Chromatic aberrations methods of minimizing	20		

	aberrations–Huygen's eyepiece–Ramsden's eyepiece.		CO1, CO2, CO3, CO4, CO5	K1, K2, K3,K4,K5, K6
II	**INTERFERENCE** Fresnel's biprism –determination of wavelength of light and thickness of thin sheet of transparent materials– Fresnel's mirrors and Lloyd's single mirror experiments– Achromatic fringes–Interference in thin films due to reflected and transmitted light–Fringes in wedge shaped films –Reflected and anti reflected coating –Michelson's interferometer– determination of wavelength of light and thickness of thin transparent sheet.	20		
III	**DIFFRACTION** Rectilinear propagation of light–Zone plate – Fresnel diffraction – Diffraction at circular aperture and straight edge – Fraunhofer diffraction – Diffraction at a single and double slit– Missing orders in double silt– Theory of diffraction grating – Determination of wavelength – Dispersive power – Rayleigh's criterion for resolution power of a telescope, and grating.	18		
IV	**POLARIZATION** Plane of polarization– Polarization of refraction – Brewster's law– pile of plates – Polarization by reflection – Malu's law – Double refraction – Nicol prism – Huygen's explanation of double refraction in uniaxial crystals– Elliptically and circularly polarized light– Quarter and half wave plates – Production and determination of plane , elliptically and circularly polarized light– Optical activity – Fresnel's theory – Specific rotation – Laurent's half shade polarimeter.	16		
V	**APPLIED OPTICS** Lasers – spontaneous and stimulated emission – Einstein's coefficients – He– Ne Laser – properties of laser beam –Carbon dioxide and Nd–YAG lasers. Semiconductor Laser –Homo junction and Hetro junction laser–Industrial and medical applications of Laser.Pockel and Kerr effect. Optical Fibers – Principle – configuration– Characteristics of optical fiber, Electromagnetic wave propagation through optical fiber, Losses and dispersion in optical fiber – wave propagation in multimode and single mode optical fibers.	16		

Text Books

1. Ajoy Ghatak, 2005, Optics, Tata McGraw Hill Co., (For Matrix methods), 3rd edition.
2. Jenkins and White, 1981, Fundamental of Optics, McGraw Hill, 4th edition.
3. Subrahmanyam, Brijlal and M. N. Avadhanulu, 2012, A Text Book of Optics, S. Chand and Co., 25th edition

4. R. Murugeshan and Kiruthika Sivaprasath, 2007, Optics and spectroscopy S. Chand Co, New Delhi, 6th edition.
5. D. R. Khanna & H. R. Gulati, 2004, Optics, Chand & Co., Pvt. Ltd., New Delhi, 20th edition.
6. R. Menzel, 2001, Photonics, Springer, 1st edition.

Suggested Readings

1. H. Lipson and D. S. Tannhauser, 1995, Optical Physics, S.G. Lipson, Cambridge University Press, 3rd edition.
2. Miles V. Klein and Thomas E. Furtak, 1986, Optics, John Wiley & Sons, 2nd edition.
3. T.P. Pearsall, 2002, Photonics Essentials: An introduction with experiments, McGraw- Hill, 1st edition.
4. Gerd Keiser, 2000, Optical Fiber Communication, McGraw -Hill International, Singapore, 3rdedition.
5. Frank L Pedrotti, 2006, Introduction to Optics, Cambridge university press, 3rd edition.
6. Eugine Hecht, 2008, Optics, Pearson Publication, 4th edition.

Web Resources

1. https://rb.gy/pfsd4a
2. https://rb.gy/p1tnhi
3. https://rb.gy/eq4tba
4. https://rb.gy/lkyewf
5. https://rb.gy/jpasef
6. https://rb.gy/d1bwpf
7. https://rb.gy/lsuwii
8. https://open.umn.edu

Course Outcomes (COs) and Cognitive Level Mapping

Cos	CO Description	Cognitive Levels
CO1	Solve problems in the way light gets reflected and refracted at the interface between different media	K1, K2
CO2	Analyze interference, diffraction patterns and differentiate between different types of polarized light.	K3
CO3	Examine the response of different materials to optical sources.	K4
CO4	Apply the principles of LASER and optical fibers to communication systems.	K5
CO5	Determine the wavelength of light and thickness of thin film using Michelson's interferometer.	K6

Course Code	UPH 5504
Course Title	PHYSICS PRACTICAL – V
Credits	03
Hours/Week	03
Category	Major Core (MC) – Practical
Semester	V
Regulation	2019

Course Overview

1. The course emphasizes the need to have hands-on- experience on measurement of physical quantities andunderstand the theoretical concepts through practical means.
2. This course aims to help in estimating physical properties such as the elastic, mechanical, electrical, magnetic and optical properties of different materials using scientific instruments.
1. Will be given training in the use of Precision measurements, calibration and error analysis.

Course Objectives

1. To determine moment of inertia of a fly wheel by dynamic method.
2. Young's modulus measurement by uniform bending.
3. Use potentiometer to calibrate a high range voltmeter and standardize it to measure thermo EMFs.
4. Use the concept of magnetic field along the axis of a circular coil to find the moment of a bar magnet.
1. Use of the spectrometer to find (i) the refractive index of the material a small angled prism and (ii) the wavelengths of mercury spectrum.

Prerequisites	Basic knowledge on usage of scientific apparatus

SYLLABUS

S.No	List of experiments	Hours Per week	COs	Cognitive levels
1	Determination of wavelength of mercury spectrum – Spectrometer – grating – minimum deviation.			
2	Spectrometer – μ – small angled prism.			
3	Comparison of mutual inductance – BG.			

4	Calibration of a high range voltmeter – potentiometer (Method1).		CO1, CO2, CO3, CO4, CO5	K1,K2,K3,K4,K5,K6
5	Young's modulus (E) – Koenig's method – Uniform bending.			
6	Moment of a bar magnet – Field along the axis of a circular coil.			
7	EMF of a thermocouple – potentiometer.			
8	Moment of inertia of a fly wheel.			

Text Books

1. Anchal Srinivasa & R.K. Shukla, 2018, Practical Physics, New age International Publishers, 2nd edition.
2. C.C. Ouseph & V. Srinivasan, 1990, A text book of Physics Practical – Part I, S. ViswanathanPublishers, 1st edition.
3. C.C. Ouseph & G. RangaRajan, 1996, A text book of Physics Practical – Part II, S.Viswanathan Publishers, 1st edition.
4. S.P. Singh, 2000, Advanced Practical Physics II, Pragati Prakashan – Meerut, 12th edition.

Suggested Readings

1. S.P. Singh, 1999, Advanced Practical Physics with Viva – voce II, Pragati Prakashan – Meerut Burke, 23rd edition.
2. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan –Meerut Burke, 23rd edition.
3. M. Nelkon & J.M. Ogborn, 1967, Advanced level Practical Physics, Heinemann Educational Books. Ltd – London, 3rd edition.
4. M. Nelkon & J.M. Ogborn, 1941, A Textbook of Practical Physics, Macmillan and Co & Limited, 4th edition.
5. Indu Prakash & Ramakrishna, 2011, A Text Book of Practical Physics, Kitab Mahal, 3rd edition.
6. Nelkon and Ogborn, 1978, Advanced level Practical Physics, Heinemann Edu. Publ., 4th edition.
7. D. Chattopadhyay & P. C Rakshit, 2011, An Advanced Course in Practical Physics, New Central Book Agency, 10th edition.
8. G.L. Squires, 2012, Practical Physics, Cambridge University Press, 4th edition.

Web Resources

1. http://emv – au.vlabs.ac.in/electricity magnetism/Circular_Coil/experiment.html.
2. http://htv – au.vlabs.ac.in/heatthermodynamics/Thermo_Couple_Seebeck_Effect/experiment.html

Course Outcomes (COs) and Cognitive Level Mapping

Cos	CO DESCRIPTION	Cognitive Levels
CO1	Define the aim of the experiment and explain the various parameter in the formula that is used to estimate the physical properties of materials. Identify the equipment and get the accessories.	K1,K2
CO2	Arrange and assemble the gadgets and carryout the experiment.	K3
CO3	List the observations and repeat the experiment to find averages and hence determine the physical quantity by making use of the required formula.	K4
CO4	Interpret and report the result and classify the materials based on the measurement. (or)Verify a given law. Sketch the variations wherever required.	K5
CO5	Analyze the results of the experiment with an aim to construct or design an equipment or a device for use in project work / research work.	K6

Course Code	UPH 5505
Course Title	PHYSICS PRACTICAL – VI
Credits	03
Hours/Week	03
Category	Major Core (MC) – Practical
Semester	V
Regulation	2019

Course Overview

1. This course emphasizes the need to systematically analyse and understand basic electronics and hence have hands-on-experience on measurements through experiment.
2. This course aims to impart knowledge on the use of electronic components like transistors, operational amplifier and ICs
1. It will enable students to design and construct electronic circuits with a specific objective.

Course Objectives

1. To design summing and difference amplifier for different voltage gains.
2. To construct an astable multivibrator using IC741.
3. Construction of D/A convertor using R-2R ladder.
4. Coding and execution of addition & subtraction in various modes of addressing using Microprocessor 8085.
5. Study the FET characteristics.
6. Construct and troubleshoot a Low pass filter using IC 741.
1. Verify the working of a 4-bit shift register

Prerequisites	Basic knowledge on usage of Integrated circuits.

SYLLABUS

S.No	List of experiments	Hours Per week	COs	Cognitive levels
1	Summing and difference amplifier – Op-amp (IC741)	3	CO1, CO2, CO3,	K1,K2,K3,K4,K5,K6
2	R-2R ladder method – D/A convertor.			
3	Colpitts Oscillator.			
4	Addition & Subtraction – Microprocessor 8085 – Three modes of addressing.			
5	Astable Multivibrator using IC741.			

6	Low pass filter – Op-amp – IC741.		CO4, CO5	
7	4- bit shift register (Left & Right).			
8	FET characteristics.			

Text Books

1. Anchal Srinivasa & R.K. Shukla, 2018, Practical Physics, New age International Publishers, 2nd edition.
2. C.C. Ouseph & V. Srinivasan, 1990, A text book of Physics Practical – Part I, S. ViswanathanPublishers, 1st edition.
3. C.C. Ouseph & G. RangaRajan, 1996, A text book of Physics Practical – Part II, S.Viswanathan Publishers, 1st edition.
4. S.P. Singh, 2000, Advanced Practical Physics II, Pragati Prakashan – Meerut, 12th edition.

Suggested Readings

1. S.P. Singh, 1999, Advanced Practical Physics with Viva – voce II, Pragati Prakashan – Meerut Burke, 23rd edition.
2. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan –Meerut Burke, 23rd edition.
3. M. Nelkon & J.M. Ogborn, 1967, Advanced level Practical Physics, Heinemann Educational Books. Ltd – London, 3rd edition.
4. M. Nelkon & J.M. Ogborn, 1941, A Textbook of Practical Physics, Macmillan and Co & Limited, 4th edition.
5. Indu Prakash & Ramakrishna, 2011, A Text Book of Practical Physics, Kitab Mahal, 3rd edition.
6. Nelkon and Ogborn, 1978, Advanced level Practical Physics, Heinemann Edu. Publ., 4th edition.
7. D. Chattopadhyay & P. C Rakshit, 2011, An Advanced Course in Practical Physics, New Central Book Agency, 10th edition.
8. G.L. Squires, 2012, Practical Physics, Cambridge University Press, 4th edition.

Web Resources

1. Virtual Labs (iitb.ac.in)
2. Web Hosting Control Panel Login (freehostia.com)
1. Analog Electronics Circuits (iitkgp.ac.in)
2. Virtual Labs (iitb.ac.in)
3. Virtual Labs (iitb.ac.in)
4. Virtual Labs (ernet.in)

Course Outcomes (COs) and Cognitive Level Mapping

Cos	CO Description	Cognitive Levels
CO1	Define the aim of the experiment and draw the essential circuit diagram and assign numerical values for various components.	K1, K2
CO2	Arrange and assemble the electronic components and carryout the experiment	K3
CO3	List the observations and record the data.	K4
CO4	Interpret and report the result and plot the graph &Verify a given law. Sketch the variations wherever required.	K5
CO5	Analyze the results of the experiment with an aim to construct or design an equipment or a device for use in project work/research work	K6

Course Code	UPH 5601
Course Title	ELECTRONICS – II
Credits	06
Hours/Week	06
Category	Major Elective (ME) - Theory
Semester	V
Regulation	2019

Course Overview

1. This course deals with the analysis and design of electronic circuits.
2. It includes various applications of Op-Amp.
3. 555 timer architecture and applications will be covered.
4. The architecture of microprocessor 8085 and its interface with 8255 PPI will be dealt in detail.
1. To enable students to write and execute simple assembly language programs for arithmetic, logic operations and interfacing.

Course Objectives

1. To understand the basic concepts of analog and digital signals
2. To gain a knowledge on 555 timer and its applications.
3. To learn the architecture and instruction set of microprocessor 8085.
4. To write programs for arithmetic and logic operations in microprocessor 8085.
1. To learn to interface 8255 to microprocessor 8085 and program it for various input/output devices.

Prerequisites	Basic knowledge on Electronics I

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**APPLICATIONS OF OPERATIONAL AMPLIFIERS** Integrator – Differentiator – solving differential equations – II order high pass and low pass filters – astable and monostable multivibrators – instrumentation amplifiers – Weighted resistor D/A converter – R-2R ladder D/A converter – parallel A/D converter – A/D conversion by counter method.	17		
II	**TIMER & PHASE LOCKED LOOP** 555 Timer – Internal architecture and working – astable and monostable operations – 555 timer as Schmitt trigger. Phase Locked Loops – 567 PLL – internal architecture and working – Lock-in-range.	14		

III	**INTRODUCTION TO MICROPROCESSOR 8085** Pin functions of 8085 – Architecture of 8085 – Instruction set – data transfer, arithmetic, logic, branching and machine control group of instructions – addressing modes of data – Simple assembly language programs – addition, subtraction, multiplication, division (by all modes of programming) – Interrupts.	16	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**ASSEMBLY LANGUAGE PROGRAMMING – MICROPROCESSOR 8085** Assembly language programs: square – square root – factorial – sorting in ascending and descending order – picking largest/smallest in an array – code conversion – subroutines.	16		
V	**INTERFACING I/O DEVICES** Types of interfacing devices – address decoding for I/O – input/output ports – Programmable peripheral interface 8255 – Features of 8255 – programming 8255.	15		

Text Books

1. Ramakant A Gayakwad, 2009, Op – amps and Linear Integrated circuits, PHI, 4th edition.
2. Ramesh S. Gaonkar, 2002, Microprocessor Architecture, Programming and Applications with the 8085, PHI, 5th edition.
3. Gupta S.L, Kumar V, 2013, A Handbook of Electronics, Pragati Prakashan, 38th edition.
4. R.P. Jain, 2009, Modern Digital Electronics, , McGraw – Hill Education, 4th edition.
5. Adithya P Mathur, 2004, Introduction to Microprocessors, McGraw – Hill Education, 3rd edition.

Suggested Readings

1. V. Vijayendran, 2009, Introduction to Integrated Electronics, Viswanathan Printers & Publishers Pvt. Ltd.,1st edition.
2. A.P Malvino, D.P. Leach, Gautam Saha, 2014, Digital Principles and Applications, Tata McGraw – Hill Education, 8th edition.
3. V. Vijayendran, 2009, Fundamentals of Microprocessor 8085, S. Viswanathan Printers & Publishers Pvt. Ltd.,1st edition.

Web Resources

1. https://nptelvideos.com/lecture.php?id=9164
2. htttps://nptelvideos.com/lecture.php?id=9164
3. https://rb.gy/8apojm
4. https://rb.gy/afchoj

Course Outcomes (COs) and Cognitive Level Mapping

Cos	CO Description	Cognitive Levels
CO1	Convert theoretical knowledge on the functions of non – linear circuits in to practical use	K1, K2
CO2	Apply the concept of timers in electronic circuits	K3
CO3	Analyze the different types of converters.	K4
CO4	Differentiate between the various input, output devises and storage methods in microprocessor 8085	K5
CO5	Construct and simulate the microprocessor 8085 based electronic circuits.	K6

Course Code	UPH 5602
Course Title	MATERIAL SCIENCE
Credits	06
Hours/Week	06
Category	Major Elective (ME) - Theory
Semester	V
Regulation	2019

Course Overview

1. This course focuses on the fundamentals of engineering materials, structure, energetics, and chemical bonding that under pin materials science.
2. It helps the students to understand the mechanical and thermal behavior of materials.
3. This course build up connections between the synthesis, design and properties of metal combinations and non-metal materials, just like their mechanical, electrical, optical and attractive properties, which are much needed for the development of new progressive materials.
4. It facilitates the students to foster subject-specific and transferable knowledge to experience the research in smart materials.
1. This course demonstrates nondestructive testing, material characteristics, electronic, magnetic materials, polymers, and smart materials.

Course Objectives

1. To understand the structure of engineering materials and chemical bonding of materials.
2. To understand the behavior of materials through mechanical and thermal properties.
3. To understand the dielectric phenomenon of materials and to analyze the behavior of smart materials in science and technological applications.
1. To apply the knowledge of engineering materials in nondestructive testing through various methods.

Prerequisites	Basic knowledge on Physics and mechanics

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**ENGINEERING MATERIALS AND CHEMICAL BONDING** Classification of engineering materials – levels of structure – structure – property relationship in materials – stability and metastability – bond energy – bond type and bond length – ionic and covalent bonding – Metallic bonding – secondary bonding – lattice energy – Born Haber cycle – cohesive energy – variation in bonding character and properties.	15	CO1, CO2, CO3, CO4, CO5	K1,K2,K3,K4,K5,K6
II	**MECHANICAL AND THERMAL BEHAVIOUR OF MATERIALS** Elastic behaviour – atomic model of elastic behaviour – Young's modulus – Poisson's ratio – shear modulus – bulk modulus – composite materials – the modulus as a parameter of design – rubber like elasticity – plastic deformation – tensile – yield strength – toughness – elongation – hardness – impact strength – stress – strain curve – Heat capacity, thermal conductivity, thermal expansion of materials.	15		
III	**MAGNETIC MATERIALS AND DIELECTRIC MATERIALS** Terminology and classification – magnetic moment due to electron spin – ferromagnetism, Antiferromagnetism and Ferrimagnetism – Influence of temperature on magnetic behaviour – Domains and Hysteresis – soft and hard magnetic materials. Polarization – electronic, ionic, orientation and space charge polarization – temperature and frequency effects – Determination of dielectric constant – dielectric loss – uses of dielectric materials – dielectric breakdown – ferroelectric materials and applications.	20		
IV	**SMART MATERIALS** Definition of smart materials – Types – Piezoelectric materials – Materials for MEMS and NEMS – Ferro fluid – Magnetic shape – memory alloys (MSMAs) – Shape memory alloy (SMA) – One way and Two way memory effect – Dielectric elastomers (DEs) –Light sensitive materials – Smart catalysts – solar cell	20		

	materials (single crystalline, amorphous and thin films) – surface acoustic wave and sonar transducer materials and applications – Introduction to Nano materials and their properties.			
V	**NON-DESTRUCTIVE TESTING AND MATERIALS CHARACTERISATION** Radiographic methods – photo-elastic methods – magnetic methods – electrical method – ultrasonic method – Equipment used for NDT – metallurgical microscope – electron microscope – scanning electron microscope (SEM). Mechanical hardness using Vickers's micro hardness tester – Principles, instrumentation and materials characterization by UV – Vis-IR, FTIR spectroscopy. Characterization of materials with electrometer – Photoconductivity – thermal properties using TG/DTA – Computer simulation of crystal structure.	20		

Text Books

1. V. Raghavan, 2015, Materials science and engineering, Prentice Hall India, 6th edition.
2. M. Arumugam, 1990, Materials Science, Anuradha Publication, 4th edition.
3. M V Gandhi & B D Thompson, 1992, Smart Materials and Structures. Chapman & Hall Publishers. 1st edition.
4. Baldev Raj, T. Jayakumar & M. Thavasimuthu, 2007, Practical Non – destructive testing, Narosa publishing house, 3rd edition.

Suggested Readings

1. Charles Kittel, 2004, Introduction to Solid State Physics, Wiley Eastern, 8th edition.
2. V.K. Manchandra, 1992, A text book of Materials Science, New India Publishing House,2nd edition.
3. Myer Kutz, 2005, Mechanical Engineers' Handbook: Materials and Mechanical Design, John Wiley & Sons, Inc., 3rd edition.

Web Resources

1. Materials science | Britannica
2. Physics & Materials Science - Science and Technology Facilities Council (ukri.org)
3. NPTEL :: Metallurgy and Material Science - Physics of Materials
4. What is Materials Science and Engineering? | Department of Materials Science and Engineering(umd.edu)
5. Materials Science and Engineering | MIT OpenCourseWare | Free Online Course Materials
6. Materials Science: 10 Things Every Engineer Should Know | Coursera

Course Outcomes (COs) and Cognitive Level Mapping

CO	CO Description	Cognitive Level
CO 1	Analyze the behavior of engineering materials based on their type, structure and composition.	K1, K2
CO 2	Calculate the stress, strain and modulus of elasticity for various engineering applications.	K3
CO 3	Identify the engineering materials by finding their mechanical properties.	K4
CO 4	Identify and classify smart materials and nano materials.	K5
CO 5	Perform computer simulations for qualitative analysis of engineering materials.	K6

Course Code	UPH 5603
Course Title	PROBLEM SOLVING SKILLS IN PHYSICS
Credits	06
Hours/Week	06
Category	MAJOR ELECTIVE (ME) – Theory
Semester	V
Regulation	2019

Course Overview

1. Competitive examination is inseparable part of higher education in science. The best way to learn the subject is through problem solving. Therefore, this paper will develop the skill of solving undergraduate Physics problems and it will enable the students to crack the competitive examinations like IIT-JAM, JEST, TIFR-GS in a more confident manner. The first unit discusses the problems involved Newtonian mechanics and demonstrates how to solve newton's second law for various physical systems.
2. This unit discusses the techniques to obtain various thermodynamical quantities like pressure, temperature, entropy, internal energy etc for a given thermodynamic system.
3. This unit discusses the problems involved in calculating potential and field for various charge configuration
4. This unit discusses the problems involved in Hermitian operators, matrices, properties of wave functions, commutators, particle in a box and harmonic oscillator problem.
5. This unit discusses problems involved the plotting in graph, error analysis, properties of matter and wave motion.

Course Objectives

1. To enable the students to solve Newtonian mechanics problems
2. To apply thermodynamical concepts into real world problems
3. To introduce the basic properties of charges and enable the students to apply in physical situations
4. To make the students understand quantum mechanical principles and solve quantum mechanical problems.
5. To enable the students to plot any functions and calculate the error involved in a physical measurement.

Prerequisites	1. Basic knowledge of integration and differentiation 2. Basic knowledge of mechanics, thermal Physics, electricity and magnetism, quantum mechanics and general Physics.

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL

I	**MECHANICS** Newton laws of motion for various systems (1, 2 and 3 dimension), Conservation laws and collisions, Rotational mechanics, Harmonic oscillator, special relativity.	20	CO1, CO2, CO3, CO4, CO5	K1,K2,K3,K4,K5 ,K6
II	**THERMAL PHYSICS** Kinetic theory – MB distribution – Laws of thermodynamics – Ideal Gas law – Various Thermodynamic processes – Entropy calculation for various process – Heat engine – TS and PV diagram – Free energies.	20		
III	**ELECTRICITY & MAGNETISM** Electrostatics – calculation of Electrostatic quantities for various configurations – Conductors, Magnetostatics – Calculation of Magnetic quantities for various configuration, Electromagnetic induction, Poynting vector, Electromagnetic waves.	15		
IV	**QUANTUM MECHANICS** Origin of Quantum mechanics – Fundamental Principles of Quantum mechanics – potential well and harmonic oscillator – angular momentum – Hydrogen atom.	20		
V	**GENERAL PHYSICS** Plotting the graphs for various elementary and composite functions –Error analysis and propagation of errors. Elasticity – Viscosity and surface tension – fluids – Buoyancy – pressure – Bernoulli's theorem – applications – waves and oscillations.	15		

Text Books

1. Charles Kittel, D Walter Knight, 2017, Mechanics (In S.I units) Berkeley Physics course (Volume 1), McGraw Hill Education, 2nd edition.
2. S. C. Garg, RM Bansal & C. K. Ghosh, 2017, Thermal Physics, McGraw Hill Education, 2nd edition.
3. E.M. Purcell & David Morin, 2013, Electricity & Magnetism, Tata McGraw Hill Education, 3rd edition.
4. N. Zettili, 2016, Quantum mechanics – Concepts & Applications, Wiley Publishers, 2nd edition.
5. H.C. Verma, 2017, Concepts of Physics Volume 1 & 2, Bharathi Bhavan Publications, 1st edition.
6. Amith Agarwal, 2019, Play with graphs, Arihant Publications, 2nd edition.
7. D.S. Mathur, 2017, Elements of Properties of matter, S. Chand Publications, 11th edition.

Suggested Readings

1. Resnick & Halliday, 2015, Principles of Physics, Wiley publications, 10th edition.
2. David J. Griffith, 2019, Introduction to Quantum mechanics, Cambridge university Press, 3rd edition.

Web Resources

1. https://rb.gy/1qlsgf
2. https://www.youtube.com/watch?v=KOKnWaLiL8w&list=PLFE3074A4CB751B2B

Course Outcomes (COs) and Cognitive Level Mapping

CO	CO Description	Cognitive Level
CO 1	Recollect and understand various concepts in mechanics, thermodynamics, quantum mechanics, electricity & magnetism	K1, K2
CO 2	Apply and articulate the concepts in various types of competitive exam problems.	K3
CO 3	Solve and illustrate the solutions for these problems	K4
CO 4	Evaluate the methods of obtaining solutions for various concept	K5
CO 5	Construct similar problems and develop method of solutions for these problems	K6

Course Code	UPH 6501
Course Title	SOLID STATE PHYSICS
Credits	06
Hours/Week	06
Category	Major Core (MC) - Theory
Semester	VI
Regulation	2019

Course Overview

1. This course aims at providing an introduction to some basic concepts in Solid State Physics.
2. Concepts such as the reciprocal lattice vector and the Brillouin zone will be introduced.
3. This course intends to provide the knowledge on lattice vibrations -and different models which contributes towards the thermal properties of materials
4. Classification of materials as conductors, semiconductors and insulators using band structure will be dealt with
5. The nature, origin and types of magnetism will be covered and an overview of superconductors will be discussed.

Course Objectives

1. To introduce the concept of crystal structure and determination of the same through X-ray diffraction.
2. To learn the theoretical model calculations of lattice vibrations which will bring out the concept of phonons and their existence through different experiments.
3. To develop first principle calculations on the band theory of solids and apply it to distinguish between different types of materials and study in detail the semiconducting behavior.
4. To study the variety of magnetic materials with reference to their response to external magnetic fields and temperature
5. To introduce the exiting phenomena of superconductivity, the associated phenomena, the recent developments and their applications.

Prerequisites	Basic knowledge of calculus, integration and differentiation.

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**CRYSTAL STRUCTURE** Solids: Amorphous and Crystalline. Lattice Translation Vectors. Unit Cell, basis. Symmetry operations – Point group and space group (Definition). Types of Lattices – Bravais lattices in three dimensions. Miller indices. Laue equations – Bragg's Law – Diffraction of X-rays	18		

	by Crystals –powder and rotating crystal method.		CO1, CO2, CO3, CO4, CO5	K1,K2,K3,K4,K5, K6
II	**ELEMENTARY LATTICE DYNAMICS** Lattice Vibrations and Phonons: – Vibrations of one dimensional Monoatomic and Diatomic lattice – Acoustical and Optical mode. Phonons: Momentum of phonons, Inelastic scattering of phonons. Specific Heat of Solids: Einstein and Debye Theories. Debye's T^3Law.	18		
III	**ELECTRICAL PROPERTIES OF MATERIALS** Elementary Band Theory of Solids. Effective Mass of Electron. Concept of Holes. Energy Band Diagram and Classification of Solids. Law of Mass Action. Insulators, and Semiconductors. Direct and Indirect Band Gap. Intrinsic and Extrinsic Semiconductors – doping – p type & n-type semiconductors. Hall Effect in Semiconductors (Qualitative Discussion Only).	18		
IV	**MAGNETIC PROPERTIES OF MATERIALS** Magnetic intensity, Intensity of magnetization, Magnetic susceptibility. Relation between μ_r&χ_m. Magnetic materials: Dia, Para, Ferro and Ferri Classical Langevin's Theory of diamagnetism and Paramagnetism – Quantum Mechanical Treatment of Paramagnetism .Curie's law, Weiss's Theory of Ferromagnetism. B–H Curve. Domains, Hysteresis and Energy Losses.	18		
V	**SUPERCONDUCTIVITY** Historical developments, Sources.Critical Temperature; Critical magnetic field.Meissnereffect. Thermodynamics of superconducting transitions. Type I and Type II Superconductors – HTS – London Equations and Penetration Depth. Isotope effect.Idea of BCS theory (No derivation): Cooper Pair and Coherence length.Variation of Energy Gap with Temperature for superconductor.AC/DC Josephson Effect (No derivation).	18		

Text Books

1. M.A Wahab, 2011, Solid State Physics, Narosa Publications, 2nd edition.
2. R.K Puri and V.K Babbar, 2018, Solid State Physics, S. Chand & Co, 1st edition

Suggested Readings

1. Charles Kittel, 2019, Introduction to Solid State Physics, John Wiley & Sons, Inc., 8th edition
2. N. W. Ascroft and N.D. Mermin, Solid State Physics, 2003, Cengage learning, 1st edition

3. M. Ali Omar, Elementary solid-state Physics: Principles and applications, 2008, Pearson Education, 4th edition.
4. A. J. Dekker, 2000, Solid State Physics, Macmillan India Ltd., 1st edition.
5. J.S. Blackmore, Solid State Physics, 1985, Cambridge University Press, 2nd edition.
6. S. O. Pillai, Solid State Physics, 2020, New Age International, 9th edition.

Web Resources

1. https://youtu.be/XQk25fSJkL8
2. https://youtu.be/93gcZEtmL7s
3. https://youtu.be/Wii1C2uVmEs
4. https://youtu.be/_ttDy8XoMes
5. https://youtu.be/t_heX7jaEfE
6. https://youtu.be/MvNAQFBppM4
7. https://youtu.be/iUM7dWWqeeY
8. https://youtu.be/QQzvQooUtJo
9. https://youtu.be/e4hS9CijS9U
10. https://youtu.be/3hB1pSjZa6c
11. https://youtu.be/DDLljK1ODeg
12. https://youtu.be/8luE9L8bj4Y
13. https://youtu.be/l0nvIh34eug
14. https://youtu.be/vnQ4uovIwR8
15. https://youtu.be/ptUPen8U5yE
16. https://youtu.be/vnQ4uovIwR8

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	Examine the symmetries in 3D solids and the experimental methods to unfold the same.	K1, K2
CO 2	Employ theoretical models to understand the lattice heat capacities of solids.	K3
CO 3	Differentiate between the variety of the electrical behavior of solids	K4
CO 4	Analyze and classify magnetic materials based on their field and temperature response.	K5
CO 5	Demonstrate magnetic levitation; an application of superconductivity.	K6

Course Code	UPH 6502
Course Title	ATOMIC AND NUCLEAR PHYSICS
Credits	06
Hours/Week	06
Category	Major Core (MC) – Theory
Semester	VI
Regulation	2019

Course Overview

1. This course is partly an extension of the previous semester's course in quantum mechanics. It helps the students to understand the microscopic nature of the physical world of atoms and nuclei.
2. The understanding of the structure atom naturally leads to an explanation of atomic and molecular spectra.
3. A discussion of atomic structure progresses to the nucleus, its constituent particles, different types of nuclei, binding energy and nuclear processes. Radioactivity and radioactive series are discussed.
4. A detailed discussion of nuclear models, nuclear energy, nuclear fission, fusion and their applications are included.
5. Finally this paper introduces elementary particle classification, their interactions, conservation laws, symmetries and a glimpse of the efforts on the unification of the fundamental interactions.

Course Objectives

1. To lay the foundation of their understanding of the subatomic realm, its constituent particles, atomic model and the angular momentum coupling schemes
2. To demonstrate the experimental support to the probabilistic theory of quantum mechanics through atomic and molecular spectra.
3. To give an overview of nucleus, its types, constituent particles, binding energy and the nuclear process of radioactivity.
4. To introduce nuclear models, origin of nuclear energy and to discuss nuclear fission and fusion along with some of their applications.
5. To give an introduction to elementary particles, their classification, interactions, conservation laws, the associated symmetries and efforts in the direction of unification of interactions.

Prerequisites	1. Understanding of the basic ideas of quantum mechanics. 2. Fundamental knowledge of calculus.

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**CHARGED PARTICLES AND ATOM MODELS** Detection of charged particles in electric and magnetic fields Specific charge of electron –Dunnigton's method Charge of electron – Millikan's method –mass of electron Bohr's atom model – hydrogen spectrum Sommerfeld's relativistic atom model – fine structure of H_α line Vector atom model and quantum numbers – spin – orbit interaction and fine structure Coupling schemes: L – S coupling and j – j coupling Pauli's exclusion principle– electron configuration.	20	CO1, CO2, CO3, CO4, CO5	K1,K2,K3,K4,K5,K6
II	**ATOMIC AND MOLECULAR SPECTRA** Fine structure of sodium doublet -Normal Zeeman effect: experiment – Quantum mechanical explanation – anomalous Zeeman effect – Paschen Back effect Molecular energies – pure rotational spectra – intensities of spectral lines Vibration – rotation spectra Rotation – vibration – electronic spectra – Frank – Condon principle Raman effect –characteristics of Raman lines – Quantum theory of Raman effect.	20		
III	**PROPERTIES OF NUCLEI AND RADIOACTIVITY** Constituents of nuclei – isotopes, isobars, isotones and mirror nuclei Nuclear mass and binding energy – unit of atomic mass BE and stability of the nucleus – mass defect and packing fraction Binding fraction versus mass number curve Nuclear size – nuclear spin – nuclear energy levels Nuclear magneton – parity of the nuclei Radioactivity: Decay law – activity of a radioactive sample Radioactive radiations – radioactive series: Displacement law – successive transformation Radioactive dating.	18		
IV	**NUCLEAR MODELS, FISSION AND FUSION** Discovery of neutron, mass, half – life period, charge, magnetic moment, production and detection Liquid drop model of nucleus – semi – empirical mass formula - Shell model – assumptions and predictions.	18		

	Nuclear fission and energy released – liquid drop theory of fission – prompt and delayed neutrons – Chain Reaction – critical mass – reproduction factor Nuclear reactor – types of reactors – breeder reactor, atom bomb - Nuclear fusion – thermonuclear reaction – source of stellar energy – uncontrolled fusion – Hydrogen bomb			
V	**ELEMENTARY PARTICLE PHYSICS** Elementary particle discovery -Classification – mesons, hyperons-Particles and antiparticles, Four fundamental interactions in nature Conservation laws (exact and approximate), CPT theorem - Resonance particles - Quarks model – unification of interactions – the standard model.	14		

Text Books

1. A B Gupta, 2009, Modern Atomic and Nuclear Physics, Books and Allied, 2nd revised edition.
2. R. Murugeshan and Kiruthiga Sivaprasath, 2016, Modern Physics, S. Chand and Co., 2016, 18th edition.

Suggested Readings

1. H. S. Mani and G.K Mehta, 1990, Introduction to modern Physics, Affiliated East – West Press, 1st edition.
2. Arthur Beiser, Shobhit Mahajan& S Rai Choudhury, 2017, Concepts of modern Physics, McGraw Hill Education, 7th Edition.

Web Resources

1. Atomic and Nuclear Physics – a quick review (utoronto.ca)
2. phy008_lecturenotes_v1 (sheffield.ac.uk)
3. NuclearPhysics.dvi (bhattadevuniversity.ac.in)
4. intro-nuclear-particle-Physics.pdf (bilkent.edu.tr)
5. Basic Nuclear and Atomic Physics (tamu.edu)
6. NPTEL :: Physics - Nuclear Physics: Fundamentals and Applications

Course Outcomes (COs) and Cognitive Level Mapping

CO	CO Description	Cognitive Level
CO 1	Analyze atomic and nuclear phenomena, behaviour of charged particles in electric and magnetic fields, atomic structure.	K1, K2
CO 2	Distinguish between different classes of nuclides, normal and anomalous Zeeman effect and nuclear fission and fusion. Use quantum principles to explain atomic spectra and generalise the ideas of atomic spectra to molecular spectra. Determine the stability of nuclides from binding energy values.	K3
CO 3	Identify different types nuclides. Estimate binding energy of the nucleons from mass defect and. Describe radioactivity and estimate the age of antiquities by applying radioactive dating. Calculate the nuclear energy released during nuclear fission and nuclear fusion. Point out the harmful effects of nuclear reactor.	K4
CO 4	Justify why fusion is considered as the source of stellar energy and argue why it is a better source of energy than fission.	K5
CO 5	Categorize elementary particles and summarize the types of interaction between them. Specify the different conservation laws and relate it with underlying symmetries.	K6

Course Code	UPH 6503
Course Title	PHYSICS PRACTICAL – VII
Credits	03
Hours/Week	03
Category	Major Core (MC) – Practical
Semester	VI
Regulation	2019

Course Overview

1. The course emphasizes the need to have hands–on – experience on measurement of physical quantities and understand the theoretical concepts through practical means.
2. This course aims to help in estimating physical properties such as the elastic, mechanical, electrical, magnetic and optical properties of different materials using scientific instruments.
3. The course also teaches the method of precision measurements, calibration and error analysis.

Course Objectives

1. To determine Planck's constant using LEDs.
2. Use of BG in the measurements of capacitance and very high resistance.
3. Standardize a potentiometer and use it to calibrate a high range voltmeter.
4. Use the concept of magnetic field along the axis of a circular coil to find the horizontal component of the earth's magnetic field.
5. Use Searle's vibration magnetometer to find moment of a bar magnet.
6. Use of the spectrometer to find (i) the refractive index of the material a prism (ii) resolving power of a grating/prism and Cauchy's constant.

Prerequisites	Basic knowledge on usage of scientific apparatus

SYLLABUS

S.No	List of experiments	Hours Per week	COs	Cognitive levels
1	Determination of Planck's constant using LEDs –at least 4 different wavelengths.			
2	Resolving power and Cauchy'sconstant – prism – Spectrometer.			

3	Spectrometer – i – i' curve.	3	CO1, CO2, CO3, CO4, CO5	K1,K2,K3,K4, K5,K6
4	Absolute capacitance of capacitor – BG.			
5	High resistance by leakage – BG.			
6	Determination of BH – field along the axis of circular coil and vibration magnetometer.			
7	Moment of a barmagnet – Searle's vibration magnetometer.			
8	Calibration of a high range voltmeter – potentiometer (Method 2)			

Text Books

1. Anchal Srinivasa & R.K. Shukla, 2018, Practical Physics, New age International Publishers, 2nd edition.
2. C.C. Ouseph & V. Srinivasan, 1990, A text book of Physics Practical – Part I, S. ViswanathanPublishers, 1st edition.
3. C.C. Ouseph & G. Ranga Rajan, 1996, A text book of Physics Practical – Part II, S.Viswanathan Publishers, 1st edition.
4. S.P. Singh, 2000, Advanced Practical Physics II, Pragati Prakashan – Meerut, 12th edition.
5. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan – Meerut, 23rd edition.

Suggested Readings

1. S.P. Singh, 1999, Advanced Practical Physics with Viva – voce II, Pragati Prakashan – Meerut Burke, 23rd edition.
2. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan – Meerut Burke, 23rd edition.
3. M. Nelkon & J.M. Ogborn, 1967, Advanced level Practical Physics, Heinemann Educational Books. Ltd-London, 3rd edition.
4. M. Nelkon & J.M. Ogborn, 1941, A textbook of Practical Physics, Macmillan and Co & Limited, 4th edition.
5. Indu Prakash & Ramakrishna (Kitab Mahal), 2011, A Text Book of Practical Physics, 3rd edition.
6. Nelkon and Ogborn, 1978, Advanced level Practical Physics, Heinemann Edu. Publ., 4th edition.
7. D. Chattopadhyay& P. C Rakshit, 2011, An Advanced Course in Practical Physics, New Central Book Agency, 10th edition.
8. G.L. Squires, 2012, Practical Physics, Cambridge University Press, 4th edition.

Web Resources

1. http://vlab.amrita.edu/?sub=1&brch=195&sim=547&cnt=1
2. http://ovau.vlabs.ac.in/optics/Cauchys_Constant/experiment.html

Course Outcomes (COs) and Cognitive Level Mapping

Cos	CO Description	Cognitive Level
CO 1	Define the aim of the experiment and explain the various parameter in the formula that is used to estimate the physical properties of materials. Identify the equipment and get the accessories.	K1, K2
CO 2	Arrange and assemble the gadgets and carryout the experiment.	K3
CO 3	List the observations and repeat the experiment to find averages and hence determine the physical quantity by making use of the required formula.	K4
CO 4	Interpret and report the result and classify the materials based on the measurement (or)Verify a given law. Sketch the variations wherever required.	K5
CO 5	Analyze the results of the experiment with an aim to construct or design an equipment or a device for use in project work / research work.	K6

Course Code	UPH 6504
Course Title	PHYSICS PRACTICAL – VIII
Credits	03
Hours/Week	03
Category	Major Core (MC) – Practical
Semester	VI
Regulation	2019

Course Overview

1. This course emphasizes the need to systematically analyse and understand basic Electronics and hands–on-experience on measurements through experiment.
2. Effective means of using electronic components like transistors, operational amplifiers and IC's through simple experiments.
3. It delivers an opportunity for students to learn, design and construct electronic circuits with a specific objective.

Course Objectives

1. Design Light to frequency converter using 555 Timer.
2. Construct and verify the working of Mod n counter (2 – 9) – using IC7493 (or) IC7490.
3. Coding and execution for Multiplication and division in various modes of addressing using Microprocessor 8085.
4. Design and study the function of FET as an amplifier.
5. Construct and troubleshoot a in High pass filter using IC 741.
6. Construct an IC regulated power supply, and study its characteristics.
7. Evaluate Boltzmann constant using IC741.

Prerequisites	Basic knowledge on usage of Integrated circuits

SYLLABUS

S.No	List of experiments	Hours Per week	COs	Cognitive levels
1	Light to frequency converter – Astable multivibrator – 555 Timer.			
2	Wien's bridge oscillator – Op-amp – IC741.			
3	FET amplifier.			

4	High pass filter – Op- amp – IC741.	3	CO1, CO2, CO3, CO4, CO5	K1,K2,K3,K4, K5,K6
5	Mod n counter (2 – 9) – IC7493 (or) IC7490			
6	Determination of Boltzmann constant – Op-amp (IC741)			
7	IC regulated power supply.			
8	Multiplication and division – Microprocessor 8085 – Three modes ofaddressing.			

Text Books

1. Anchal Srinivasa & R.K. Shukla, 2018, Practical Physics, New age International Publishers, 2nd edition.
2. C.C. Ouseph & V. Srinivasan, 1990, A text book of Physics Practical – Part I, S. ViswanathanPublishers, 1st edition.
3. C.C. Ouseph & G. RangaRajan, 1996, A text book of Physics Practical – Part II, S.Viswanathan Publishers, 1st edition.
4. S.P. Singh, 2000, Advanced Practical Physics II, Pragati Prakashan – Meerut, 12th edition.

Suggested Readings

1. S.P. Singh, 1999, Advanced Practical Physics with Viva – voce II, Pragati Prakashan – Meerut Burke, 23rd edition.
2. S.L. Gupta & V. Kumar, 1999, Practical Physics, Pragati Prakashan –Meerut Burke, 23rd edition.
3. M. Nelkon & J.M. Ogborn, 1967, Advanced level Practical Physics, Heinemann Educational Books. Ltd – London, 3rd edition.
4. M. Nelkon & J.M. Ogborn, 1941, A Textbook of Practical Physics, Macmillan and Co & Limited, 4th edition.
5. Indu Prakash & Ramakrishna, 2011, A Text Book of Practical Physics, Kitab Mahal, 3rd edition.
6. Nelkon and Ogborn, 1978, Advanced level Practical Physics, Heinemann Edu. Publ., 4th edition.
7. D. Chattopadhyay& P. C Rakshit, 2011, An Advanced Course in Practical Physics, New Central Book Agency, 10th edition.
8. G.L. Squires, 2012, Practical Physics, Cambridge University Press, 4th edition.

Web Resources

1. https://ae – iitr.vlabs.ac.in/exp/astable – monostable – multivibrator/theory.html
2. https://ae – iitr.vlabs.ac.in/exp/wein – bridge – oscillator/simulation.html
3. http://vlabs.iitkgp.ernet.in/tcad/fet/index.html
4. http://vlabs.iitb.ac.in/vlab/electrical/exp10/index.html
5. https://rb.gy/e8wjt7
6. https://ae – iitr.vlabs.ac.in/exp/voltage – regulator/pretest.html
7. http://vlabs.iitb.ac.in/vlabs – dev/labs_local/microprocessor/labs/exp3/index.php
8. http://vlabs.iitb.ac.in/vlabs – dev/labs_local/microprocessor/labs/exp3/index.php

Course Outcomes (COs) and Cognitive Level Mapping

Cos	CO Description	Cognitive Level
CO 1	Define the aim of the experiment and draw the essential circuit diagram and assign numerical value for various components.	K1, K2
CO 2	Arrange and assemble the electronic components and carry out the experiment.	K3
CO 3	List the observations and record the data.	K4
CO 4	Interpret and report the result and plot the graph and verify a given law. Sketch the variations wherever required.	K5
CO 5	Analyze the results of the experiment with an aim to construct or design an equipment or a device for use in project work/research work.	K6

Course Code	UPH 6701
Course Title	COMPUTATIONAL PHYSICS AND WORKSHOP TECHNOLOGY
Credits	05
Hours/Week	06
Category	Major Skill (MS)
Semester	VI
Regulation	2019

Course Overview

1. Python is a general-purpose, versatile and popular programming language. This course gives exposure to students as to how to us Python works and appreciate its place in the world of programming languages.
2. This course gives introduction to Python, Data types, variables, simple functions, math, flow control.
3. This course gives the application of python programming to physics problems.
4. This course also gives an introduction to machine shop technology.
5. Various machine tools like cutter, driller, lathe and grinding machines will be explained.

Course Objectives

1. To learn Python which enables the students to compute mathematical logics and modeling.
2. To understand and execute simple programs in Python.
3. To write and solve numerical problems using Python programming.
4. To acquire the theoretical and practical knowledge of workshop technology.
5. To gain knowledge of driller, cutter, shaper and lathe machines and their usage.

Prerequisites	Basic knowledge on Higher Secondary Physics and Numerical methods

SYLLABUS

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**INTRODUCTION TO PYTHON** Introduction – Python shell – Data types: Numbers (int, float, complex), Using python as calculator – Basic arithmetic – Operator precedence – Methods and attributes – Mathematical functions – Variables – Variable names – Comparison and logic: operators – Logical, conditional – Immutability and identity.	15		

II	**STRINGS AND FUNCTIONS** Strings – Definition – Indexing and slicing – string methods – Print function – lists – list method – tuples – use of tuples – loops – control flow: if elif else, while, break, pass, continue – file input and output – functions – Defining, calling – Simple plotting with pylab.	15	CO1, CO2, CO3, CO4, CO5	K1,K2,K3,K4,K5,K6
III	**NUMERICAL METHODS USING PYTHON** Packages –Numpy: Basic array methods, matrices, Matplotlib: Basics, Scipy: Physical constants and special functions – Integrationand ordinary differential equations, Interpolation – Newton forward interpolation,Lagrange interpolation – Simpson and Trapezoidal method – Euler method – Roots of equation (Newton – Raphson method).	15		
IV	**WORKSHOP TOOLS AND DEVICES** Steel Scale, Scribers, Punches, Hammers, calipers, Dividers, Try square, V block, Surface plate, Angle plate, Marking block, Height gauge, Marking, Vices – Cutting Tools – Hacksaw, Chisels, Files, Dies, Taps, Screw thread – Cutting speed, Feed – lubricants – Drills. Drill chuck – Reamers – Drilling machines–Types – Drilling– Measuring Instruments, Vernier calipers – Vernier depth gauge Micrometer – Types – Dial indicator Bevel protractor, Gauges.	16		
V	**TOOLS APPLICATION** Steel – Properties – Heat treatment – Types of steel – Lathe – Types, Different parts – Types of work done – Accessories – Lathe work – Lathe Cutting Tools, Tool angles, Grinding – Types of tools – Shapes, Setting tools in tool posts – P tool materials – Rivets – Riveting – Sheet metal works – Tools used – Locking devices. Grinding – grinding wheels – welding soldering.	17		

Text Books

1. Learning scientific programming with Python, Christian Hill, Cambridge university press, 2016, 1st edition.
2. Essential Python for Physicists, Giovanni Moruzzi, Springer publications, 2020, 1st edition.
3. Elements of Workshop Technology, S. K. Hajra Choudhury, A. K. Hajra Choudhury, Nirjhar Roy, Media Promoters and Publishers Pvt. Ltd, 2020, Volume 1, 15th edition.

Suggested Readings

1. Introduction to Python for science & Programming, David J Pine, CRC Press, 2018, 1st edition.
2. W.A.J Chapman, 1972, Workshop Technology: Part I, Taylor and Francis, 1st edition.

Web Resources

1. https://nptel.ac.in/courses/106/106/106106212/
2. https://nptel.ac.in/courses/112/104/112104290/

Course Outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive Level
CO 1	Understand the syntax in Python language, differentiate between Python programs with other programming languages and various tools involves in workshop technology	K1, K2
CO 2	Develop simple programs using arithmetic and logical operators using Python	K3
CO 3	Use the various workshop and lathe tools to real life applications.	K4
CO 4	Assess the python program solvability to physics problems and estimate various quantities that involved using workshop tools	K5
CO 5	Create python programs to solve ordinary differential equations in physics and obtain the skill on lathe cutting, drilling, bending and grinding usingworkshop technology	K6

Course Code	UPH 6705
Course Title	INTERNSHIP
Credits	05
Days	30
Category	Major Skill (MS)
Semester	VI
Regulation	2019

Internship/Field visit

Internship is a professional learning experience that offers meaningful, practical work related to students' field of study or course interest. It gives students an opportunity for career exploration and development. It allows the students to gain hands on experience and industry exposure. The internship for UG is conducted during the Christmas Vacation for minimum of 30 days. The UG students will be sent to industries/organizations.

Rubrics for evaluation of Internship

S. No	Criteria	Max. Marks
1.	Industry/Organization profile	10
2.	Thrust areas and specialization	10
3.	Internship module and participation	20
4.	Expertise of the industry/organization	10
5.	Regularity and hands on training	10
6.	Presentation/Demonstration	20
7.	Report writing	20

Course Code	UPH 6705
Course Title	SKILL BASED LAB
Credits	05
Hours/Week	06
Category	Major Skill (MS)
Semester	VI
Regulation	2019

Course Overview

1. This practical lab course gives the hands on training in writing and executing python programs.
2. It gives practice on various lathe tools and house hold wiring.
3. It also teaches the usage of drilling machines
4. It gives practice on various lathe tools and house hold wiring techniques
5. It also teaches how to use drilling machine and making small boxes in a desired shapes and dimensions

Course Objectives

1. Write simple programs using Python.
2. Understand the data types, simple functions, math and flow control.
3. Able to write and execute numerical problems using Python Programming
4. Gain practical knowledge of workshop technology.
5. Learn the usage of driller, cutter, shaper and lathe machines in the lab.

Prerequisites	Basic knowledge on Higher Secondary Physics and Numerical methods

SYLLABUS

S.No	List of experiments	Hours Per week	COs	Cognitive levels
1	Python programming – simple arithmetic operations I			
2	Python programming – simple arithmetic operations II			
3	Python programming – Arrays			
4	Python programming – Matrices		CO1,	

5	Python programming – Solving differential equations	6	CO2, CO3, CO4, CO5	K1,K2,K3,K4, K5,K6
6	Python programming – Trapezoidal and Simpson Rule			
7	Python programming – Lagrange's interpolation method			
8	Python Programming – Newton' Raphson method			
9	Shaping to the planned dimensions.			
10	Cutting and bending.			
11	Using drilling machines for various requirements.			
12	Different types of welding.			
13	Boxes of different sizes			
14	Wood work.			
15	Experiments using lathe.			

Text Books

1. Christian Hill, 2016, Learning scientific programming with Python, Cambridge university press, 1st edition.
2. Giovanni Moruzzi, 2020, Essential Python for Physicists, Giovanni Moruzzi, Springer publications,1st edition.
3. S. K. Hajra Choudhury, A. K. Hajra Choudhury, Nirjhar Roy, 2020, Elements of Workshop Technology, Media Promoters and Publishers Pvt. Ltd, Volume 1, 15th edition.

Suggested Readings

1. David J Pine, 2018, Introduction to Python for science & Programming, CRC Press, 1st edition.
2. W.A.J Chapman, 1972, Workshop Technology: Part I, Taylor and Francis, 1st edition.

Web Resources

1. https://nptel.ac.in/courses/106/106/106106212/
2. https://nptel.ac.in/courses/112/104/112104290/

Course Outcomes (COs) and Cognitive Level Mapping

Cos	CO Description	Cognitive Level
CO 1	Understand the syntax in Python language.	K1, K2
CO 2	Develop effective programming skills in Python	K3
CO 3	Solve Physics problems in numerical methods using Pytthon.	K4
CO 4	Use of the various lathe tools in real life applications.	K5
CO 5	Develop python programs to solve ordinary differential equations in physics.	K6

CL AND CO BASED CIA QUESTION PAPER FORMAT FOR THE DEPARTMENT OF PHYSICS

SECTION	MARKS	Q. NO	K1	K2	K3	K4	K5	K6
A	Answer ALL (6 x 1 = 6)	1	+					
		2	+					
		3	+					
		4		+				
		5		+				
		6		+				
B	Answer 1 out of 2 (1 x 6 = 6)	7			+			
		8			+			
C	Answer 1 out of 2 (1 x 6 = 6)	9				+		
		10				+		
D	Answer 1 out of 2 (1 x 12 = 12)	11					+	
		12						+
No. of CL based Questions with Max. marks			3 (3)	3 (3)	1 (6)	1 (6)	1 (12)	1 (12)
No. of CO based Questions with Max. marks			CO 1		CO 2	CO 3	CO 4	CO 5
			6 (6)		1 (6)	1 (6)	1 (12)	1 (12)

- The above template is applicable for MC-Major Core, AR–Allied Regular, AO–Allied Optional, MS-Major Skill, ME-Major Elective and NME-Non-Major Elective

- **Section A** will have one or more of the following: Definition, Comment on, Reason out etc., But, K1 and K2 should carry equal weightage. **Section B** will have two questions of K3 level and **Section C** two questions of K4 level. In **Section D** students have choice between K5 andK6.
- III Component Assessment carries 40% of CIA and the assessment(s) should be for cognitive levels K1 to K4 and all should carry equal weightage.

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI 600 034

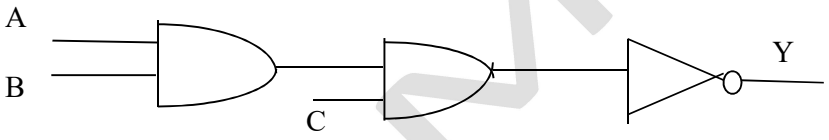
Department of Physics

FIRST CONTINUOUS ASSESSMENT TEST, JULY, 2021

UPH 1502 – INTRODUCTION TO DIGITAL ELECTRONICS (MC)

I BSc Physics 15.07.2021

Time : 10.00 am to 11.30 am Max. Marks : 30

SECTION A			
Answer ALL the Questions in one or two sentences			**(6 x 1 = 6 Marks)**
1.	State De Morgan's theorem.	K1	CO 1
2.	Identify A (A+ B) = A	K1	CO 1
3.	Identify the complement of (A + B) (B+C) (C+ A)	K1	CO 1
4.	Discuss NOT gate with its truth table.	K2	CO 1
5.	Differentiate between a demultiplexer and a decoder.	K2	CO 1
6.	Explain an encoder circuit?	K2	CO 1
SECTION B			
Answer any ONE of the following in 150 words			**(1 x 6 = 6 Marks)**
7.	Construct the truth table for the given circuit 	K3	CO 2
8.	Apply the logical function of three variables F(A,B,C) = A + BC to standard SOP expression.	K3	CO 2
SECTION C			
Answer any ONE of the following in 150 words			**(1 x 6 = 6 Marks)**
9.	Sketch the XOR and EXNOR gates and give its truth table.	K4	CO 3
10.	Calculate $(65,535)_{10}$ to its hexadecimal and binary equivalents.	K4	CO 3
SECTION D			
Answer any ONE of the following in 100 words			**(1 x 12 = 12 Marks)**
11.	Analyze using only NAND gates the following combinational circuit. Use K – map to obtain the expression $F(A,B,C,D) = \Sigma\ (2,3,4,6,10,11,15) + \Sigma_d\ (7, 12,13)$	K5	CO 4
12.	Evaluate the following expression to five literals F (A,B,C) = ABC + ABC + ABC+ ABC+ ABC	K6	CO 5

CL AND CO BASED END SEMESTER EXAMINATION QUESTION PAPER TEMPLATE FOR THE DEPARTMENT OF PHYSICS

SECTION		Q. NO	K1	K2	K3	K4	K5	K6
A	(10 x 2 =20) Answer ALL	1	+					
		2	+					
		3	+					
		4	+					
		5	+					
		6		+				
		7		+				
		8		+				
		9		+				
		10		+				
B	(2 x 10 = 20) Answer 2 out of 4	11			+			
		12			+			
		13			+			
		14			+			
C	(2 x 10 = 20) Answer 2 out of 4	15				+		
		16				+		
		17				+		
		18				+		
D	(2 x 20 = 40) Answer 2 out of 5	19					+	
		20					+	
		21					+	
		22						+
		23						+
No. of CL based Questions with Max. marks			5 (10)	5 (10)	2 (20)	2 (20)	3 (40)	2 (40)
No. of CO based Questions with Max. marks			CO 1		CO 2	CO 3	CO 4	CO 5
			10(20)		2 (20)	2 (20)	3 (40)	2 (40)

* The above template is applicable for MC-Major Core, AR–Allied Regular, AO–Allied Optional, MS-Major Skill, ME-Major Elective.

GUIDELINES FOR SETTING THE SEMESTER QUESTION PAPER

Section A	**(10 x 2 = 20 Marks)**
2 questions from each unit with K1 Level (1 question) and K2 level (1 question)	
Section B	**(2 × 10 = 20 Marks)**
4 questions out of which 2 should be answered. (K3 level) 11. UNIT 1 12. UNIT 2 13. UNIT 3 14. UNIT 4 OR 5	
Section C	**(2 × 10 = 20 Marks)**
4 questions out of which 2 should be answered. (K4 level) 15. UNIT 1 OR 2 16. UNIT 3 17. UNIT 4 18. UNIT 5	
Section D	**(2 × 20= 40 Marks)**
1 question from each unit and any 2 to be answered (K5, K6 level) 3 questions at K5 level and 2 questions at K6 level.	

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI 600 034

Department of Physics

END SEMESTER EXAMINATION, OCTOBER, 2021

UPH 1502 INTRODUCTION TO DIGITAL ELECTRONICS (MC)

I BSc Physics 15.11.2021

Duration: 3 hrs Max. Marks : 100

SECTION A			
Answer ALL the Questions			
	Define the following	**(10 x 2 = 20 Marks)**	
1.	State De Morgan's law.	K1	CO 1
2.	Convert the decimal equivalent of $(10010)_2$	K1	CO 1
3.	Discuss the concept of Multiplexer	K1	CO 1
4.	Define Flip flop	K1	CO 1
5.	Enumerate the four rules of binary addition.	K1	CO 1
6.	Convert the Boolean equation Y= AB+CD into logical circuit	K2	CO 1
7.	Distinguish between encoder and decoder.	K2	CO 1
8.	Express $(101011)_2$ in decimal numbers	K2	CO 1
9.	Convert 2's complement of 10110	K2	CO 1
10.	Explain NAND LATCH	K2	CO 1
SECTION B			
Answer any TWO of the following in 150 words		**(2 x 10 = 20 Marks)**	
11.	Construct the logic gates OR, NAND and NOR gates with circuit diagram and explain it with appropriate truth table	K3	CO 2
12.	Sketch the circuit of 8-input multiplexer and explain in detail	K3	CO 2
13.	Calculate a) $(48)_{10}$ to HEX b) $(7FF)_H$ to binary c) $(111101\ 11101)_2$ to decimal	K3	CO 2
14.	Applying NAND gate, Construct the working of a D-Flip flop with neat sketch.	K3	CO 2
SECTION C			

Answer any TWO of the following in 150 words			**(2 x 10 = 20 Marks)**
15.	Analyse and explain NAND is a universal gate	K4	CO 3
16.	Explain the SOP expression for the sum and carry of a full adder from the truth table and simplify them.	K4	CO 3
17.	Compare the truth table and corresponding circuit for the given expression Y= $AB + \bar{B}C$ and $A\bar{B} + B\bar{C}$	K4	CO 3
18.	Analyze the function of a decoder and draw the gate equivalent circuit of a 3-8 decoder.	K4	CO 3
	SECTION D		
Answer any TWO of the following in 250 words			**(2 x 20 = 40 Marks)**
19.	Summarize the circuit of (i) BCD to seven segment decoder (ii)Decimal to BCD encoder	K5	CO 4
20.	Evaluate the following function using Karnaugh map Y = F(A, B, C, D)= $\sum (1,3,7,11,15) + \sum_d (0,2,5,8)$	K5	CO 4
21.	a) Write this subtraction in binary form $(47)_{10} - (23)_{10}$ using 2's complement subtraction. b) Predict the sum and carry of a Half Adder with a circuit diagram and truth table	K6	CO 5
22.	Predict the output of JK Flip flop by explaining its working with a circuit diagram and truth table.	K5	CO 5
23.	a) Write $(45)_{10}$ in binary and gray code. b) Estimate the number $(65,535)_{10}$ to its hexadecimal and binary equivalents	K6	CO 5

UNIT WISE DISTRIBUTION OF CL AND CO BASED QUESTIONS AND MARKS FOR END OF SEMESTER QUESTION PAPER SETTING FOR UG COURSES

(MC, AR, AO, MS, ME and GL)

	SECTION A (1 Mark/Question)		**SECTION B (10 Marks/Question)**	**SECTION C (10 Marks/Question)**	**SECTION D (20 Marks/Question)**	
	K1	**K2**	**K3**	**K4**	**K5**	**K6**
UNIT I	2 (1)	2 (1)	-	1 (10)	1 (20)	
UNIT II	2 (1)	2 (1)	1 (10)	1 (10)	1 (20)	-
UNIT III	2 (1)	2 (1)	1 (10)	1 (10)	1 (20)	-
UNIT IV	2 (1)	2 (1)	1 (10)	1 (10)	-	1 (20)
UNIT V	2 (1)	2 (1)	1 (10)	-	-	1 (20)
No. of CL based Questions with Max. Marks	**10 (10)**	**10 (10)**	**2 (20)**	**2 (20)**	**2 (40)**	**2 (40)**
No. of CO based Questions with Max. Marks	**CO 1**		**CO 2**	**CO 3**	**CO 4**	**CO 5**
	20 (20)		**2 (20)**	**2 (20)**	**2 (40)**	**2 (40)**

MC-Major Core, **AR**–Allied Regular, **AO**–Allied Optional, **MS**-Major Skill, **ME**-Major Elective, **GL**-General Languages.
In Section D students have choice between K5 and K6.

CL AND CO BASED MARKS DISTRIBUTION FOR DIRECT ASSESSMENTS OF UG COURSES

MC, AR, AO, MS, ME and GL

SECTION	**CL**	**COs**	**CIA I**	**CIA II**	**III Component**	**Semester**	**Total (200)**	**CL and CO %**
A	K1, K2	CO 1	6	6	20	20	52	26%
B	K3	CO 2	6	6	10	20	42	21%
C	K4	CO 3	6	6	10	20	42	21%
D	K5, K6	CO 4, CO 5	12	12	-	40	64	32%

MC-Major Core, **AR**–Allied Regular, **AO**–Allied Optional, **MS**-Major Skill, **ME**-Major Elective, **GL**-General Languages.

COGNITIVE LEVEL (CL) AND COURSE OUTCOME (CO) BASED

ASSESSMENT METHOD FOR LAB CIA EXAMINATION (UG)

Assessment	Criteria	Marks (50)	COGNITIVE LEVEL (CL)			
			K1, K2	K3	K4	K5, K6
CIA Practical Test for 50 marks	Writing the aim, formula, circuit etc.	10	+			
	Observing readings, calculations, applying principles etc.	20		+		
	Evaluating the final result experimentally and viva-voce	10				+
	Observation and Record Work	10			+	
No. of CL based Questions with Max. marks			1 (10)	1 (20)	1 (10)	1 (10)
No. of CO based Questions with Max. marks			CO 1	CO 2	CO3	CO 4, CO 5
			5 (50)			

COGNITIVE LEVEL (CL) AND COURSE OUTCOME (CO) BASED ASSESSMENT METHOD FOR UG LAB SEMESTER EXAMINATION

Assessment	Criteria	Marks (100)	COGNITIVE LEVEL (CL)			
			K1, K2	K3	K4	K5, K6
Semester Practical Examination for 50 marks	Writing the aim, formula, circuit etc.	20	+			
	Observing readings, calculations, applying principles etc.	40		+		
	Evaluating the final result experimentally	30				+
	Viva-voce	10			+	
No. of CL based Questions with Max. marks			1 (20)	1 (40)	1 (30)	1 (10)
No. of CO based Questions with Max. marks			CO 1	CO 2	CO 3	CO 4, CO 5
			5 (100)			

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI 600 034

Department of PHYSICS

PRACTICAL CIA EXAMINATION, JULY, 2021

UPH 1503 PHYSICS PRACTICAL I (MC)

I BSc Physics Practical 16.07.2021

Time: 10.30 am to 12.30 pm Max. Marks: 50

1	Recall and write the formula for rigidity modulus of the wire using a torsional pendulum with symmetrical masses.	K1, K2	CO 1	10 Marks
2	Experiment with the given wire to find the oscillations for different lengths with masses at distances d1 and d2 and find the radius of the wire using screw gauge.	K3	CO 2	20 Marks
3	Evaluate and give the solution for the rigidity modulus of the given wire using the formula.	K5, K6	CO 4, CO 5	10 Marks
4	Observation and record note book.	K4	CO 3	10 Marks

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END SEMESTER EXAMINATION, JULY, 2021

UPH 1503 PHYSICS PRACTICAL I (MC)

I BSc Physics Practical 16.07.2021

Time: 10.00 am to 1.00 pm Max. Marks: 100

1	Recall the basic logic gates OR, AND, NOT, NAND and NOR using IC and verify the truth table.	K1, K2	CO1	20 Marks
2	Construct the basic logic gates OR, AND, NOT, NAND and NOR using the given IC.	K3	CO 2	40 Marks
3	Interpret and list the readings and predict the output of the circuits.	K5 K6	CO 4 CO 5	30 Marks
4	Viva-Voce	K4	CO 3	10 Marks