HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI-620002

SCHOOL OF PHYSICAL SCIENCES

PG AND RESEARCH DEPARTMENT OF PHYSICS

CHOICE BASED CREDIT SYSTEM

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)

Programme Outcomes (POs)

PO 1 Demonstrate ability and attitude to acquire knowledge and skills in the advancing global scenario to apply them effectively and ethically for professional and social development.

PO 2 Involve in research and innovative endeavours and share their findings for the wellbeing of the society

PO 3 Work effectively in teams and take up leadership in multi-cultural milieu.

PO 4 Act with moral, ethical and social values in any situation.

PO 5 Excel as empowered woman to empower women.

PO 6 Participate in activities towards environmental sustainability goals as responsible citizens.

PO7 Pursue higher studies in the related fields of science, humanities and management.

PO8 Analyse and record the results obtained using experimental and analytical techniques in physical, chemical and biomedical laboratories

PO9 Develop a range of generic skills related to self-employment and entrepreneurship in areas related to Physical Sciences.

Programme Specific Outcomes (PSOs)

PSO1 Appraise the concepts of Physics in classical Mechanics, Quantum Mechanics, Modern Physics and Electrodynamics to observe and appreciate the diverse phenomena in nature.

PSO2 Apply the mathematical tools and theoretical concepts to solve complex physical problems.

PSO3 Propose new concepts with multidimensional and multidisciplinary approach to make human life easy & interesting.

(For Candidates admitted in the Academic year 2022-2023)

HOLY CROSS COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI – 620 002
SCHOOL OF PHYSICAL SCIENCES
PG AND RESEARCH DEPARTMENT OF PHYSICS
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)
UG COURSE PATTERN
B.Sc. PHYSICS

Sem	Part	Course	Title of the Course	Code	Hrs/Wk	Credits	Marks
I	I	Language - 1	General Tamil I/ Hindi Paper I/ French Paper I	U22TL1GEN01/ U22HN1HIN01/ U22FR1FRE01	3	3	100
	II	English – 1	General English I	U22EL1GEN01	3	3	100
	III	Major Core – 1	Properties of Matter	U22PH1MCT01	5	4	100
		Major Core – 2	Optics	U22PH1MCT02	5	4	100
		Major Core – 3	Main Practical I: General Physics Practicals	-	3	-	-
		Allied - 1	Mathematics I Algebra, Calculus, Trigonometry	U22MA1ALT01	4	2	100
		Allied - 2	Mathematics II Analytical Geometry of Three Dimensions and Vector Calculus	U22MA1ALT06	4	2	100
	IV	Environmental Studies	Environmental Studies	U22ES1EVS01	2	1	100
		Value Education	Ethics/ Bible studies/	U22VE2LVE01/ U22VE2LVB01/ U22VE2LVC01	1	--	--

			Catechism				
			Service Oriented Course		--	--	--
			Internship/ Field Work Field Project 30 Hours Extra Credit	U22EX1INT01		2 (Extra Credits)	100
	TOTAL				**30**	**19+2**	**700+100**

Sem	Part	Course	Title of the Course	Code	Hrs/Wk	Credits	Marks
II	I	Language - 2	General Tamil II/ Hindi Paper II/ French Paper II	U22TL2GEN02/ U22HN2HIN02/ U22FR2FRE02	3	3	100
	II	English – 2	General English II	U22EL2GEN02	3	3	100
	III	Major Core – 3	Main Practical I: General Physics Practicals	U22PH2MCP03	3	4	100
		Major Core – 4	Heat, Thermodynamics and Statistical Physics	U22PH2MCT04	6	5	100
		Major Core – 5	Mechanics	U22PH2MCT05	5	4	100
		Allied - 3	Mathematics III - Laplace Transform, Partial Differential Equations and Fourier Series	U22MA2ALT08	4	2	100
	IV	Skill Based Course (SBC)- 1	Soft skill developm ent	U22SS2SBC01	2	1	100
		Skill Based Course (SBC)- 2	Sustainable Rural Development and Student Social Responsibility	U22RE2SBC02	2	1	100
		Industrial Relations	Photovoltaic Systems	U22PH2IRT01	1	1	100
		Value Education	Ethics/Bible studies/Catechism	U22VE2LVE01/ U22VE2LVB01/ U22VE2LVC01	1	1	100
			RESCAPES	U22EX2RES01		1 (Extra Credit)	-
			Service Oriented Course		--	--	
			Internship 30 Hours –Extra Credit	U22EX2INT02	--	2 (Extra Credits)	100
		Extra Credit	Online Course	U22EX2ONC01	-	1 (Extra Credit)	100
	TOTAL				**30**	**25+4**	**1000+200**

Sem	Part	Course	Title of the Course	Code	Hrs/Wk	Credits	Marks
III	I	Language – 3	General Tamil III/ Hindi Paper III/ French Paper III	U22TL3GEN03/ U22HN3HIN03 U22FR3FRE03	3	3	100
	II	English – 3	General English III	U22EL3GEN03	3	3	100
	III	Major Core – 6	Electricity and Electromagnetism	U22PH3MCT06	4	4	100
	III	Major Core – 7	Main Practical II- Optics, Electricity and Electronics Practicals	U22PH3MCP07	6	4	100
	III	Allied Paper – 4	Allied Chemistry/ Allied Computer Science		4	2	100
	III	Major Elective – 1			4	3	100
	IV	Major Skill Based Course - I			2	1	100
	IV	Non Major Elective – 1			2	2	100
	IV	Gender Studies		U22WS3GST01	1	1	100
	IV	Extra Credit	Online Course	U22EX3ONC02	-	1 (Extra Credit)	100
	IV	Value Education	Ethics/Bible Studies/Catechism		1	--	--
			Service Oriented Course		--	--	--
			Internship/Field work/Field Project – 30 Hours – Extra Credit	U22EX3INT03	--	2 (Extra Credits)	100
	TOTAL				**30**	**23+3**	**900+ 200**

Sem	Part	Course	Title of the Course	Code	Hrs/Wk	Credits	Mark s
IV	I	Language – 4	General Tamil IV/ Hindi Paper IV/ French Paper IV	U22TL4GEN04/ U22HN4HIN04/ U22FR4FRE04	3	3	100
	II	English – 4	General English IV	U22EL4GEN04	3	3	100
	III	Major Core – 8	Electronics	U22PH4MCT08	5	5	100
	III	Major Core – 9	Digital Electronics	U22PH4MCT09	4	4	100
	III	Allied Paper-5	Allied Chemistry/ Allied Computer Science		4	2	100
	III	Allied Paper -6	Allied Chemistry/ Allied Computer Science		4	2	100
	III	Major Elective – 2			4	3	100
	IV	Non Major Elective – 2			2	2	100
	IV	Value Education	Ethics/Bible Studies/ Catechism		1	1	100
			Service Oriented Course	U22EX4SOC01	--	2(Extra Credit)	100
			RESCAPES	U22EX4RES02		1(Extra Credit)	
			Internship/Field work/Field Project – 30 Hours – Extra Credit	U22EX4INT04	--	2 (Extra Credits)	100
	TOTAL				**30**	**25+5**	**900+ 200**

Sem	Part	Course	Title of the Course	Code	Hrs/ Wk	Credits	Marks
V	III	Major Core –10	Classical and Quantum Mechanics	U22PH5MCT10	5	5	100
	III	Major Core – 11	Atomic and Molecular Physics	U22PH5MCT11	5	4	100
	III	Major Core – 12	Main Practical III: Advanced Electronics & Digital Practicals	U22PH5MCP12	6	4	100
	III	Major Core – 13	Spectroscopy	U22PH5MCT13	5	5	100
	III	Major Elective – 3	Circuit and Network Analysis/ Geophysics	U22PH5MET03/ U22PH5MET04	4	3	100
	IV	Non Major Elective – 3			2	2	100
	IV	Major Skill Based Course -II	Problem solving skills in Physics	U22PH5SBT02	2	1	100
	IV	Value Education	Ethics/Bible studies/Catechism		1	--	--
			Internship/Field work/Field Project – 30 Hours – Extra Credit	U22EX5INT05	-	2 (Extra Credit)	100
		Extra Credit	Online Course	U22EX5ONC03	-	1(Extra Credit)	100
		Total			**30**	**24+3**	**700 +200**

Sem	Part	Course	Title of the Course	Code	Hrs/ Wk	Credits	Marks
VI	III	Major Core - 14	Mathematical Physics	U22PH6MCT14	5	5	100
	III	Major Core -15	Solid State Physics	U22PH6MCT15	5	4	100
	III	Major Core - 16	Nuclear and Particle Physics	U22PH6MCT16	5	5	100
	III	Major Core - 17	Main Practical IV : Advanced Digital and Microprocessor Practicals	U22PH6MCP17	6	4	100
	III	Major Elective – 4	Microprocessor INTEL8085/ Astro Physics	U22PH6MET05/ U22PH6MET06	4	3	100
	IV	Non Major Elective – 4			2	2	100
	IV	Skill Based Course (SBC) - 3	Research Methodology	U22DS6SBT03	2	1	100
	IV	Value Education	Value Education Ethics/Bible studies/Catechism		1	--	100
	IV		Internship/Field work/Field Project – 30 Hours – Extra Credit	U22EX6INT06	-	2 (Extra Credit)	100
	IV		RESCAPES	U22EX6RES03		1(Extra Credit)	100
	TOTAL				**30**	**24+3**	**800 + 100**
	GRAND TOTAL				**180**	**140+20**	**5000+ 800**

Allied papers offered by department of Physics

Sem	Part		Course	Title of the Course	Code
I	III	For Chemistry	ALLIED 1	Basic Physics I	U22PH1ALT01
		For Chemistry	ALLIED 2	Basic Physics Practicals	U22PH1ALP02
		For CS	ALLIED 2	Digital Electronics	U22PH1ALT03
II	III	For Chemistry	ALLIED 3	Basic Physics II	U22PH2ALT04
III	III	For Maths	ALLIED 4	Properties of Matter, Optics and Sound	U22PH3ALT05
	III	For B. Voc.(SD)	ALLIED 4	Digital Electronics and Microprocessor	U22PH3ALT06
	III	For Biotechnology	ALLIED 4	Biophysics	U22PH3ALT07
	III	For Bioinformatics	ALLIED 4	Biophysics	U22PH3ALT07
IV	III	For Maths	ALLIED 5	Allied Physics Practicals	U22PH4ALP08
	III	For Maths	ALLIED 6	Modern Physics, Electricity and Electronics	U22PH4ALT09
	III	For C.S.	ALLIED 5	Fundamentals of microprocessor INTEL 8085	U22PH4ALT10
	III	For C.S.	ALLIED 6	Digital and Microprocessor practicals	U22PH4ALP11

Major elective papers offered by the Department of Physics:

Sem	Part	Course	Title of the Course	Code	Hrs/Wk	Credits	Marks
III	III	Major Elective -1	Domestic Power Generation and HouseWiring	U22PH3MET01	4	3	100
IV	III	Major Elective – 2	Sensors	U22PH4MET02	4	3	100

Non - Major elective papers offered by the Department of Physics:

Sem	Part	Course	Title of the Course	Code	Hrs/Wk	Credits	Marks
III	IV	Non Major Elective – 1	Explore the Universe	U22PH3NMT01	2	2	100
IV	IV	Non Major Elective – 2	Basic Science (L/T)	U22PH4NMT02	2	2	100
V	IV	Non Major Elective – 3	Physics of Photography	U22PH5NMT03	2	2	100
VI	IV	Non Major Elective – 4	Physics for competitive Exams	U22PH6NMT04	2	2	100

(For Candidates admitted in the Academic year 2022-2023)

Course Title	MAJOR CORE 1: PROPERTIES OF MATTER
Code	U22PH1MCT01
Course Type	Theory
Semester	I
Hours /Week	5
Credits	4
Marks	100

CONSPECTUS

To understand the basic principles and concepts of Elasticity, torsion, viscosity, surface tension, diffusion, Osmosis and Plasma.

COURSEOBJECTIVES

1. To recall the basic ideas of properties of matter.
2. To understand the experimental determination of surface tension, coefficient of viscosity, Diffusivity and osmotic pressure.
3. To understand the theory of plasma production and plasma measurements.
4. To apply the concept of Bernoulli's theorem to venturimeter, filter pump, atomizer.
5. To analyze the concepts with the applications and employ them to solve problems.

UNIT I: ELASTICITY **15 Hrs**

Elastic behaviour, Stress - strain relationship, Hooke's law–Different moduli of elasticity-Young's modulus(E) - Rigidity modulus(G) – Bulk modulus(K)- Poisson's ratio - work done in linear, shearing and volume strain - Relation connecting elastic constantsandPoisson'sratio–Bendingofbeams-Cantileverdepressionandoscillation - Measurement of Young's modulus by non-uniform bending, uniform bending and cantilever depression- I shaped girders -Torsion: couple per unit twist for solid and hollow cylinders - Work done in twisting a wire–static torsion method–Factors affecting elastic materials.

Extra Reading/Keywords: *cohesion, adhesion*

UNITII: SURFACE TENSION **15 Hrs**

Surface tension - free energy of a surface - excess pressure inside a liquid drop and a soap bubbles - work done in blowing a bubble- Angle of contact - Pressure difference across a liquid surface - Experimental determination of surface tension - variation of surface tension with temperature-Drop weight method- Capillary rise method.

Extra Reading/Keywords: *Zurin's law, vibrational frequency of levitated drops*

UNIT III: VISCOSITY **15 Hrs**

Viscosity–coefficient of viscosity-streamline flow and turbulent flow-critical velocity -Poiseuille's formula for the flow of liquid through a capillary tube- corrections to Poiseuille's formula - Poiseuille's method for determining co-efficient of viscosity of a liquid- comparison of viscosity - Oswald viscometer-Bernoulli theorem-

venturimeter-filter pump- atomizer.

Extra Reading /Keywords: *stoke's law*

UNIT IV: DIFFUSION AND OSMOSIS **15 Hrs**

Diffusion-Graham's laws of diffusion-Fick's law – coefficient of diffusion– determination of coefficient of diffusion -Osmosis – Osmotic pressure experimental determination of osmotic pressure: Berkeley and Hartley method – Laws of osmotic pressure – analogy between heat conduction and osmotic pressure – Difference between diffusion and osmosis.

Extra Reading/Keywords: *Molasses, Lubricants, Turgor pressure, Dialysis*

UNITV: BASICS OF PLASMA **15 Hrs**

Introduction to plasma- Plasma as a state of matter- Natural plasma: Ionosphere- van allen belts- aurorae- solar corona- core of the sun- HII regions-Debye shielding-The Plasma requency- Plasma production through ionization -Plasma production by laser - Applications of plasma physics- controlled thermonuclear fusion.

Extra Reading /Keywords: *plasma waves, Tokmak*

TEXTBOOKS

1. Murugeshan. R, Properties of Matter, S.Chand & Company Ltd, New Delhi(2016).
2. Mathur D.S, Elements of properties of matter, S.Chand & Company Ltd, New Delhi (2010).
3. Brijlal and N. Subramanian, Properties of Matter, S.Chand &Co, New Delhi (2002).
4. Chandra, Suresh, Text book of Plasma Physics, CBS Publishers and Distributions Pvt Ltd, New Delhi(2012).
5. Bittencourt J A, Fundamentals of Plasma Physics, New Delhi: Springer (India) Pvt Ltd, (2006).

SUGGESTED READINGS

1. Halliday D Resnic R and Walker J,FundamentalsofPhysics,6th edition,Wiley,NY,(2000).
2. Michaelde Podesta, Understanding the properties of Matter, CRC Press(2002).
3. Agarwal B.S, Dr. Nabindranath Mishra, A Text Book of Mechanics and Properties of Matter, KedarNath RamNath Publishers (2020).

WEB REFERENCES

1. https://nios.ac.in/media/documents/SrSec312NEW/312_Physics_Eng/312_PhysicsEngLesson8.pdf
2. https://chem.libretexts.org/Courses/Oregon_Institute_of_Technology
3. http://hyperphysics.phy-astr.gsu.edu/hbase/Kinetic/diffus.html
4. https://www.britannica.com/science/viscosity
5. https://www.britannica.com/science/plasma-state-of-matter

COURSEOUTCOMES:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO 1	Recall the concept of elastic materials, elastic properties, torsion, Surface energy, fluid properties and fourth state of matter.	K1
CO 2	Understand the relation between different moduli of elasticity, explain the determination of Rigidity modulus, surface tension, differentiate stream line and turbulent flow of motion, diffusivity, osmotic pressure and explain the production of plasma.	K2
CO 3	Apply physics principles learnt such as bending of beams, torsion, angle of contact, Bernoulli's theorem, diffusion, osmosis and Debye length to solve practical problems.	K3
CO 4	Analyze the importance of the applications of elastic moduli, I shaped girders and different properties of matter such as surface tension, viscosity, diffusion, osmosis and plasma properties	K4

PO – CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	M	H	M	L	L	M	L	L
CO2	H	H	M	M	L	M	M	M	L
CO3	H	H	M	M	M	L	L	H	M
CO4	H	H	M	M	L	M	L	H	H

PSO – CO MAPPING

	PSO1	PSO2	PSO3
CO1	H	M	L
CO2	H	H	H
CO3	M	H	M
CO4	H	H	H

(For Candidates admitted in the Academic year 2022-2023)

Course Title	MAJOR CORE 2: OPTICS
Code	U22PH1MCT02
Course Type	Theory
Semester	I
Hours/Week	5
Credits	4
Marks	100

CONSPECTUS:

To make the students understand the concepts of aberrations in lens, interference of light, diffraction, polarization, laser and basics of nonlinear optics.

COURSE OBJECTIVES:

1. To remember the phenomenon of reflection and refraction, the lens system, aberration and understand the methods of minimizing spherical and chromatic aberrations, Ramsden's and Huygen's eyepieces.
2. To apply the concept of interference to determine the thickness of the wire and test the planes of a surface wavelength of sodium and monochromatic light.
3. To explain the term diffraction, normal incidence, dispersive power of grating.
4. To understand the concepts Optical activity, Rotatory Polarization and determine the specific rotator power of sugar solution using Laurent's half shade polarimeter.
5. To remember the basic principles of LASER and understand the various types of LASER.
6. To understand the fundamentals of non-linear optics and basics of harmonic generation

UNIT I: LENSES AND ABERRATIONS 15 Hrs

Lens System - Aberration in lenses - Spherical aberration in a lens -methods of minimizing spherical aberration - Chromatic aberration in lens– Condition for achromatism for two thin lenses in contact and separated by a distance- - Huygen's and Ramsden's eyepieces - Comparison of Huygen's and Ramsden'seyepieces.

Extra Reading / Keywords: *simple experiment using lens, Laser tuning, Optical coherence tomography systems*

UNIT II: INTERFERENCE 15 Hrs

Introduction - Theory of Interference fringes -Wedge shaped films - Air wedge - determination of diameter of a thin wire - Testing the planeness of a surface-Newton's rings - theory and experiment- Experimental determination of refractive index of liquid. - Michelson's Interferometer - Determination of wavelength of monochromatic light and difference in wavelength between neighboring lines.

Extra Reading / Keywords: *Flatness testing, Fabry- Perot Interferometer*

UNIT III: DIFFRACTION AND POLARIZATION **15 Hrs**

Diffraction -Fresnel diffraction and Fraunhofer diffraction – grating – Normal incidence– Dispersive power of a grating - Resolving power of a grating.

Optical activity- Rotatory Polarisation – Fresnel's theory of optical rotation – Specific rotation – Biot's law for Laurent's half shade polarimeter – Determination of specific rotatory power of sugar solution.

Extra reading / Key words: *DVD, Liquid crystal display, Polaroid filter*

UNIT IV: LASER **15 Hrs**

Absorption and Emission - Spontaneous emission - Stimulated emission -Einstein coefficients - Characteristics of LASER -population inversion- pumping - Types of LASER- Solid state LASERS : Ruby - Nd:YAG LASER - Gas LASER : He-Ne LASER- Semiconductor LASER : Diode LASER - Applications of LASER in medicine and industry.

Extra Reading / Keywords: *Photons, Excitation*

UNIT V: INTRODUCTION TONON-LINEAR OPTICS **15 Hrs**

Linear and nonlinear – Non-linear optics –Wave propagation in an anisotropic crystal- Polarization response of materials to light- Harmonic generation-Second harmonic generation- Sum and difference frequency generation-Phase matching-Third harmonic generation- bi stability- Self focusing.

Extra reading / Key words: *Non- linear optical processes, Non- linear fiber optics*

TEXT BOOKS

1. Murugeshan, R and Kiruthiga Sivaprasath, Optics and Spectroscopy, S. Chand and Company, Ltd.(2010).
2. Laud B.B, Lasers and Nonlinear Optics, New Age international (P) Ltd. New Delhi, 2nd Edition (1991).
3. Avadanalu M. N., An Introduction to Lasers, S. Chand & Company, New Delhi (2001).
4. Nambiar. K.R., Laser principles Types and Applications, New age International, New Delhi(2004).
5. Ghatak A.K., Lasers theory and Applications, MacMillan India Ltd, New Delhi (2003).
6. Baruah G.D., Essentials of Lasers and Non – linear Optics, Pragati Prakashan, Meerut,2006.

SUGGESTED READINGS

1. Subramaniyam N, Brijlal and Avadhanulu. M.N, A Text Book of Optics, S.Chand and Company, Ltd (2007).
2. Murugeshan, R Optics and Spectroscopy S. Chand and Company, Ltd.(1997).
3. Robert W. Boyd, Nonlinear Optics, 2nd Edn., Academic Press, New York(2003).

WEB REFERENCES

1. https://wiki.metropolia.fi/display/Physics/Laser+technology%2C+definition%2C+applications%2C+and+challenges
2. http://www.infocobuild.com/education/audio-video-courses/physics/IntroToNonlinearOptics-IIT-Kharagpur/lecture-45.html
3. http://hyperphysics.phy-astr.gsu.edu/hbase/geoopt/eyepiece.html

COURSE OUTCOMES:

The Learner will be able to:

COs	CO Description	Cognitive Level
CO1	recall the aberrations of lens systems, various properties of light such as interference, diffraction, polarization, and state the principles of LASER and non-linear optics.	**K1**
CO2	understand the interaction of light with matter and explain interference, diffraction, polarization, aberrations of lens systems, LASER and non-linear optics.	**K2**
CO3	apply the theoretical concepts and demonstrate different experiments with optical devices to find the optical properties of the material and use it to solve the real time problems. Classify and explain the different types of LASERS and non linear optics.	**K3**
CO4	analyze and reason out the changes occurred in the properties of light ,compare conventional light with LASER light and extend the concept of LASER to non-linear optics to explain the harmonic generations.	**K4**

PO – CO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	**H**	**M**	**M**	**M**	**H**	**H**	**M**	**H**	**M**
CO 2	**H**	**M**	**H**	**M**	**H**	**H**	**M**	**H**	**H**
CO 3	**H**	**H**	**M**	**M**	**H**	**H**	**H**	**H**	**H**
CO 4	**H**	**H**	**M**	**M**	**H**	**H**	**H**	**H**	**H**

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3
CO 1	**H**	**M**	**M**
CO 2	**H**	**H**	**M**
CO 3	**H**	**M**	**H**
CO 4	**H**	**H**	**H**

(For Candidates admitted in the Academic year 2022-2023)

Course Title	MAJORCORE3:MAIN PRACTICALI-GENERAL PHYSICS PRACTICALS
Code	U22PH1MCP03
Course Type	Practical
Semester	I & II
Hours/Week	3
Credits	4
Marks	100

CONSPECTUS

To apply the basic principles of properties of matter, Electricity, Electronics and Optics by doing the relevant experiments.

COURSE OBJECTIVES

1. To evaluate the Young's modulus of the given material by various methods.
2. To apply the basic principles of optics to determine the thickness of a wire by using Air wedge method, to find the radius of curvature of the lens by forming Newton's rings, refractive index of prism and the refractive index of given liquids.
3. To apply the concept surface tension and viscosity by doing simple experiment like drop weight method, Capillary rise method, Poiseuille's flow method & Oswald viscometer.
4. To evaluate the temperature coefficient of thermistor using post office box.
5. To analyze the characteristics of electronic devices such as Junction diodes and ammeter calibration.
6. To apply the concept of digital electronics by doing simple experiments using discrete component.

Any Fourteen Experiments Only

1. Determination of Young's modulus by non-uniform bending - Microscope
2. Determination of Young's modulus by uniform bending - Telescope
3. Determination of Young's modulus by Cantilever method - Microscope
4. Determination of Rigidity modulus of a rod by Static Torsion method
5. Measurement of Specific Resistance of a wire using Potentiometer
6. Determination of Refractive Index of material of a prism using Spectrometer
7. Characteristics of P-N Junction Diode
8. Study of Logic gates using discrete components – AND, OR & NOT
9. Determination of thickness of a wire by forming Air Wedge
10. Determination of Refractive Index of the given liquid using Spectrometer
11. Determination of co-efficient of viscosity of liquid by burette method
12. Determination of the surface tension of a liquid by drop weight method
13. Determination of temperature coefficient of thermistor using P.O Box
14. Determination of refractive index of material by forming Newton's rings.
15. Determination of focal length, radius of curvature and refractive index of convex, concave lens and combination of convex and concave lenses.
16. Determination of co-efficient of viscosity of liquid by constant pressure head.
17. Comparision of co-efficient of viscosity of liquid by Oswald Viscometer.
18. Determination of the surface tension of a liquid by capillary rise method.
19. Determination of frequency of a tuning fork by fall plate method.
20. Determination of viscocity of air by Rankine's method.

WEB REFERENCE

1. http://mpv-au.vlabs.ac.in/modern-physics/Abbes_Refracrometer/experiment.html
2. http://ov-au.vlabs.ac.in/optics/Spectrometer_Refractive_Index/experiment.html
3. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/engg_physics/labs/exp1/simulation/ simulator.html
4. http://vlabs.iitkgp.ernet.in/be/exp5/index.html#
5. https://vlab.amrita.edu/?sub=1&brch=280&sim=602&cnt=1
6. https://vlab.amrita.edu/index.php?brch=190&cnt=1&sim=339&sub=2

COURSE OUTCOMES

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO-1	Recall the elastic, optical, electrical, electronic, mechanical and properties of matter.	K1
CO-2	Understand the phenomenon of interference of light, distinguish between elastic/inelastic and rigid / flexible Materials by measuring moduli of elasticity, the basic concept of thermal physics and electronics.	K2
CO-3	Apply the principle of Wheatstone bridge to measure the temperature co-efficient of thermistor and basic principles of optics to measure the thickness of a wire and refractive index of material.	K3
CO-4	Analyze the V-I characteristics, elastic behavior of the materials by their modulus, viscous nature of fluids to correlate with the Physics theory.	K4

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	**H**	**H**	**M**	**M**	**H**	**M**	**H**	**H**	**H**
CO-2	**H**	**H**	**M**	**M**	**H**	**M**	**H**	**H**	**H**
CO-3	**H**	**H**	**M**	**M**	**H**	**M**	**H**	**H**	**H**
CO-4	**H**	**H**	**M**	**M**	**H**	**M**	**H**	**H**	**H**

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	**H**	**H**	**H**
CO-2	**H**	**H**	**H**
CO-3	**H**	**H**	**H**
CO-4	**H**	**H**	**H**

(For Candidates admitted in the Academic year 2022-2023)

Course Title	**BASIC PHYSICS – I** (for Chemistry)
Code	**U22PH1ALT01**
Course Type	**Theory**
Semester	**I**
Hours /Week	**4**
Credits	**2**
Marks	**100**

CONSPECTUS:

To understand the basics of Optics, Properties of matter, Kinetic theory of gases, Heat, Thermodynamics and Atomic Physics

COURSE OBJECTIVES:

1. To recall the properties of light and apply it to study the behavior of light in optics.
2. To recall the stress, strain, viscosity and surface tension.
3. To understand the basic ideas of kinetic theory of gases.
4. To understand the concept of transmission of heat and Entropy
5. To apply thermo dynamical laws to heat engine.
6. To understand ,Pauli's Exclusion Principle and Mosley's law
7. To analyze photoelectric effect in different cells.

UNIT I: OPTICS **12 Hrs**

Refraction - Refraction through prism- Refractive index - Interference - Condition for Interference - Air wedge -Newton's rings - Diffraction - Theory of grating - Difference between prism and grating spectrum- Determination of wavelength of light using transmission grating (Normal incidence)

Extra Reading / Keywords: *Dispersion, Deviation*

UNIT II: PROPERTIES OF MATTER **12 Hrs**

Elasticity -Elastic constants –Hooke's law -Theory of Bending of beams - Young's modulus by non-uniform bending -Rigidity modulus - Static torsion. Viscosity -Coefficient of viscosity - Poissuelle's formula - Comparison of viscosities by burette method - Viscosity of highly viscous liquids - Stoke's law. Surface tension- Molecular theory of Surface tension - Surface tension by drop weight method

Extra Reading / Keywords: *Angle of twist, Flow of liquid*

UNIT III: KINETIC THEORY OF GASES **12 Hrs**

Introduction- Concepts of ideal gas-Elements of kinetic theory of gas-Pressure exerted by gas-Brownian motion-Degrees of freedom-Equipartition of energy – Relation between molar specific heats and degrees of freedom-Specific heats of mono atomic, Di-atomic, Triatomic gases-Van der Waals' Equation of State- Mean free path.

Extra Reading/ Keywords: *Evaporation, Thermionic emission*

UNIT IV: HEAT AND THERMODYNAMICS **12 Hrs**

Conduction – Convection – Radiation- Thermal conductivity- Lee's disc method - Determination of coefficient of thermal conductivity– Black body -Kirchhoff's law of radiation.

Laws of thermodynamics-Thermodynamic equilibrium - Internal energy – Entropy – Changes in Entropy in reversible and irreversible processes – T-S Diagram – Carnot's ideal heat engine - Derivation of its efficiency in terms of temperatures.

Extra Reading / Keywords: *Temperature of inversion, Heat transfer, Energy, State coordinates*

UNIT V: ATOMIC PHYSICS **12 Hrs**

Vector Atom Model - Pauli's Exclusion Principle.- X-ray - Properties - Characteristic and continuous Spectrum- Mosley's law and its importance – Compton Scattering -Photo electric effect - Laws of photoelectric effect - Einstein's equation - Applications of Photo electric effect- Photo electric cells.

Extra Reading / Keywords: *Photon, Photoelectrons, Bragg's law*

TEXT BOOKS

1. Murugesan.R, Allied Physics, S. Chand & Co. Ltd., New Delhi (2005).
2. Brijlal and Subramaniam, Text Book of Optics, S. Chand &Co.Ltd., New Delhi (1998).
3. Brijlal, Subramaniam & P. S. Hemne, Heat, Thermodynamics and statistical physics, S. Chand & company Ltd., New Delhi (2007).
4. Rajam J.B,Atomic Physics, S.Chand & Co., New Delhi (2010).

SUGGESTED READINGS

1. Mathur D.S, Mechanics. S.Chand & Co. Ltd., (2007).
2. Chakrabharti P.K, Geometrical and Physical optics, New central book agency Pvt. Ltd., (2005).
3. David Halliday, Robert Resnik, Kenneta S.Krane, The Physics, John Willey and sons, Singapore (2005).
4. Murugeshan R and Kiruthiga Sivaprasath, Properties of matter and Acoustics (2^{nd} ed.), S. Chand & company Ltd. New Delhi (2012).
5. Rajam J.B and Arora C.L., A Text Book of Heat and Thermodynamics, S. Chand & Co,New Delhi (1983).

WEB REFERENCES

1. https://www.olympus-lifescience.com/en/microscope-resource/primer/lightandcolor/interference/
2. https://www.britannica.com/science/viscosity
3. https://byjus.com/jee/kinetic-theory-of-gases/
4. https://byjus.com/physics/carnot-engine/
5. https://byjus.com/jee/photoelectric-effect/

COURSE OUTCOMES:

The Learner will be able to:

COs	Course Description	Cognitive Level
CO 1	recall the concepts of physics such as optics, properties of matter, Kinetic theory of gases, heat and atomic physics	K1
CO 2	understand the theory of optics, properties of matter, Kinetic theory of gases, heat and atomic physics	K2
CO 3	apply the theoretical knowledge of optics, properties of matter, Kinetic theory of gases, heat and atomic physics to demonstrate the experiments and solve the real-time problems.	K3
CO 4	analyze the experimental data and interpret the results obtained from the experiments on optics, properties of physics, Kinetic theory of gases, heat and atomic physics.	K4

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	**H**	**H**	**H**	**M**	**M**	**H**	**M**	**H**	**M**
CO-2	**H**	**H**	**H**	**M**	**M**	**H**	**M**	**H**	**M**
CO-3	**H**	**H**	**M**	**M**	**M**	**H**	**H**	**H**	**M**
CO-4	**H**	**H**	**H**	**M**	**M**	**H**	**H**	**H**	**H**

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	**H**	**M**	**H**
CO-2	**H**	**H**	**H**

CO-3	**M**	**H**	**H**
CO-4	**M**	**H**	**H**

(For Candidates admitted in the Academic year 2022-2023)

Course Title	**BASIC PHYSICS PRACTICALS–I** (For Chemistry)
Code	**U22PH1ALP02**
Course Type	**Practical**
Semester	**I**
Hours/Week	**4**
Credits	**2**
Marks	**100**

CONSPECTUS:

To understand the basics of Properties of matter, Optics, Electricity and Electronics by doing related experiments.

COURSE OBJECTIVES

1. To evaluate the Young's modulus and Rigidity modulus of the given material.
2. To apply the concept surface tension and viscosity by doing simple experiment like drop weight method, and Poiseuille's flow method.
3. To understand the functions of logic gates by constructing them using discrete components
4. To apply the basic digital concepts to perform Half Adder, Half subtractor, NAND and NOR universal gate.
5. To apply the properties of light to determine thickness of thin wire by using Air wedge method, to find the radius of curvature by forming Newton's rings and the refractive index of prism.
6. To analyze V-I characteristics of junction diode, Zener diode and transistor.

Any Fourteen experiments only

1. Determination of Young's modulus of the material of a bar by Non-uniform bending using (Pin and Microscope).
2. Determination of Rigidity modulus of the material of a rod- Static Torsion.

3. Comparison of viscosities of two liquids using burette method.
4. Determination of Surface Tension by Drop Weight method.
5. Determination of Radius of Curvature of a lens-Newton's Rings.
6. Determination of refractive index of the material of prism using Spectrometer.
7. Determination of thickness of a wire – Air wedge.
8. Determination of specific heat capacity of a liquid by Newton's law of cooling method.
9. Determination of temperature coefficient of thermistor using Post Office Box.(Room Temperature and Cooling).
10. Study of Junction Diode characteristics.
11. Study of Zener Diode characteristics.
12. Construction and study of Bridge Rectifier.
13. Construction and study of Regulated Power Supply using Zener Diode
14. Study of transistor characteristics– Common Emitter configuration.
15. Study of AND, OR Logic gates using discrete components.
16. Study of NAND and NOR as Universal logic gates.
17. Verification of Demorgan's Theorems using IC chips.
18. Study of half adder and half subtractor using IC chips.
19. Determination of wavelength LASER light source using diffraction method.
20. Determine the horizontal intensity of earth's magnetic field using magnetometer.

SUGGESTED READINGS:

1. Ouseph C.C., Rao U.J., Vijayendran. V, Practical Physics and Electronics, S. Viswanathan (Printers and Publishers), Pvt., Ltd., (2007).
2. Srinivasan M.N, Balasubramanian S., Ranganathan R., Text Book of Practical Physics, Sultan Chand &Sons (2013)

WEB REFERENCES:

1. http://vlabs.iitkgp.ernet.in/be/exp10/zenercharac.html
2. http://vlabs.iitkgp.ernet.in/be/exp10/znrli_ver1.html
3. http://vlabs.iitkgp.ernet.in/be/exp11/index.html
4. http://mpv-au.vlabs.ac.in/modern-physics/Abbes_Refracrometer/experiment.html
5. http://ov-au.vlabs.ac.in/optics/Spectrometer_Refractive_Index/experiment.html
6. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/engg_physics/labs/exp1/simulation/simulator.html
7. http://vlabs.iitkgp.ac.in/be/exp5/index.html

COURSEOUTCOMES:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO-1	Remember the basic concepts elastic, optical, electrical, electronics & properties of matter.	K1
CO-2	Understand the phenomenon of interference of light, surface tension, viscosity of liquids.	K2
CO-3	Apply optical principles to measure the refractive index of the prism using the spectrometer, interference pattern by Air wedge Method, radius of curvature of the lens by forming Newton's rings method, AND/OR logic operations to solve simple logic circuits.	K3
CO-4	Analyze the V-I characteristics of a p-n junction diode, zener diode, transistors, nature of elastic materials and viscous nature of fluids.	K4

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	**H**	**M**	**H**	**M**	**M**	**H**	**H**	**M**	**H**
CO-2	**H**	**M**	**H**	**M**	**M**	**H**	**M**	**M**	**H**
CO-3	**H**	**M**	**H**	**M**	**M**	**H**	**H**	**M**	**H**
CO-4	**H**	**M**	**H**	**M**	**M**	**H**	**H**	**M**	**H**

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	M	H	M
CO-2	M	H	M
CO-3	M	H	H
CO-4	M	H	H

(For Candidates admitted in the Academic year 2022-2023)

Course Title	ALLIED PHYSICS 1:DIGITAL ELECTRONICS (For Computer Science)
Code	U22PH1ALT03
Course Type	Theory
Semester	I
Hours/Week	4
Credits	2
Marks	100

CONSPECTUS

To understand the fundamentals Digital Electronics such as number system, logic gates, Boolean algebra and simplification of Boolean expressions, Combinational and sequential circuits and memories.

COURSE OBJECTIVES

1. To understand the basics of digital electronics and different number systems and conversion between them.
2. To simplify the Boolean expression using Karnaugh map and implement it using gate networks.
3. To analyze and design efficient arithmetic and combinational logic circuits.
4. To apply the sequential logic circuits to design the digital devices of shift registers and counter.
5. To explain the nomenclature and technology in the area of memory devices.
6.

UNIT I : NUMBER SYSTEMS, CODES ANDBOOLEAN ALGEBRA 12Hrs

Binary Number System - Binary-to decimal Conversion - Decimal-to-binary Conversion- Octal Numbers - Hexadecimal Numbers - The ASCII Code - The Excess-3 Code - The Gray Code. Boolean operations – Rules and Laws of Boolean Algebra- Algebraic simplification of Boolean expressions.

Extra reading / Key words: *8421 code, 2421 code, 4221 code, IBM machines*

UNIT II: LOGIC GATES AND SIMPLIFICATION OF BOOLEAN EQUATIONS12 Hrs

AND, OR, NOT, NAND, NOR, EX-OR gates – operation and truth tables– DeMorgan's theorems – NAND and NOR as Universal Building block - Boolean expressions for gate networks — Minterms-Sum of Products– Karnaugh map forming up to four variables - Simplification using Karnaugh map.

Extra reading / Key words: *EX - NOR gate, Max term, Product of sum*

UNIT III: ARITHMETIC,COMBINATIONAL CIRCUITS 12Hrs

Binary arithmetic – 1's and 2's complements- Half adder – Full adder – Half subtractor – Full subtractor - Multiplexer: 4-1 Multiplexer, 8-1 Multiplexer – Demultiplexer: 1-4 Demultiplexer, 1-16 Demultiplexer – Decoder: 3-8 decoder, BCD to Seven segment decoder– Encoder.

Extra reading / Key words: *Full subtractor, Latches, Combinational circuit*

UNIT IV: SEQUENTIAL CIRCUITSANDREGISTERS 12Hrs

Flip Flops- SR Flip Flop, Clocked SR Flip Flop, D Flip Flop, JK Flip Flop, JK Master Slave Flip Flop - T Flip Flop - Registers - Shift registers – Shift Left and Shift Right registers-Parallel Shift registers-Asynchronous counters – Modulo –N counter.

Extra reading / Key words: *SISO, SIPO, PIPO, PISO, mod -12 counter, BCD counter*

UNITV: MEMORY 12Hrs

Introduction – Semiconductor memory: RAMs, ROM, PROM, EPROM, EEPROM, Flash memory - Magnetic Memory - Optical Memory - Virtual Memory- Cache Memory-Memory Hierarchy - Memory Addressing.

Extra Reading / Keywords: *Magnetic tape, Hard disk drive*

TEXT BOOKS

1. Vijayendran V. Introduction to Integrated Electronics Digital and Analog, S. Viswanathan (Printers & Publishers) Pvt., Ltd, 1st Edition (2009).
2. Floyd, Digital Fundamentals, Pearson Education, India, 11th Edition(2018).
3. R. P. Jain, Modern Digital Electronics, Tata McGraw - Hill Education, New Delhi, 4th Edition (2010).
4. Ram B. Fundamentals of Microprocessors and Microcomputer, Dhanapat Rai Publications (P) Ltd, New Delhi 8th Edition (2013).

SUGGESTED READINGS

1. William H. Gothmann, Digital Electronics- An Introduction to theory & Practice, Prentice Hall of

India 2nd Edition (2012).

2. Malvino. A and Leach, Digital Principles and Applications, Mc-Graw Hill, New York, 8th Edition (2015).
3. A. P. Mathur, Introduction to Microprocessors, Tata McGraw-Hill Education(1989).
4. Andrea Redaelli and Fabio Pellizzer, Semiconductor Memories and Systems, Woodhead Publishing Series in Electronic and Optical Materials, 1st Edition(2022).
5. M. Morris Mano, Michael D Ciletti, Digital Design, Pearson Publisher, 4th Edition(2008).

WEB REFERENCES

1. https://nptel.ac.in/courses/117/105/117105080/
2. https://www2.southeastern.edu/Academics/Faculty/kyang/2018/Spring/CMPS375/ClassNotes/CMPS375ClassNotesChap03.pdf
3. http://class.ece.iastate.edu/arun/Cpre381/lectures/registers.pdf
4. https://www.javatpoint.com/classification-of-memory
5. https://mswista.files.wordpress.com/2015/04/typesofmemory_updated.pdf

COURSE OUTCOMES:

The Leaner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO 1	recall the basic knowledge of binary number systems, binary arithmetic, basic logic gates, laws of Boolean algebra, De Morgan's theorem, flip flops and memories.	K1
CO 2	understand the fundamentals of conversion of number systems, NAND and NOR as universal gates and explain the arithmetic, combinational circuits, sequential circuits and concept of memories.	K2
CO 3	apply various conversion techniques involved in code conversion, K – mapping, arithmetic, combinational and sequential circuits and classify the types of memory.	K3
CO 4	analyze the arithmetic, combinational and sequential circuits and memories and simplification of logical expressions using Boolean algebra and K-mapping.	K4

PO – CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	**H**	**M**	**M**	**M**	**M**	**H**	**H**	**H**	**H**
CO 2	**H**	**H**	**M**	**M**	**H**	**H**	**H**	**H**	**H**
CO 3	**H**	**H**	**M**	**M**	**H**	**H**	**H**	**H**	**H**

CO 4	**H**	**H**	**M**	**M**	**H**	**H**	**H**	**H**	**H**

PSO – CO MAPPING

	PSO1	PSO2	PSO3
CO 1	**M**	**H**	**H**
CO 2	**M**	**H**	**H**
CO 3	**M**	**H**	**H**
CO 4	**M**	**H**	**H**

(For Candidates admitted in the Academic year 2022-2023)

Course Title	**Major Core4: Heat, Thermodynamics and Statistical Physics**
Code	**U22PH2MCT04**
Course Type	**Theory**
Semester	**II**
Hours/Week	**6**
Credits	**5**
Marks	**100**

CONSPECTUS

To understand the fundamental concepts of Heat, Thermodynamics and Statistical Physics.

COURSE OBJECTIVES

1. To remember the laws of thermodynamics, the properties of gas and different types of heat transmission.
2. To understand the basic ideas of kinetic theory of gases, working of heat engines.
3. To understand different methods to measure thermal parameters and different types of ensembles in statistical physics.
4. To apply the concepts of kinetic theory of gases in atmosphere physics and the laws of thermodynamics in engines.
5. To apply low temperature physics and heat transmission in real time applications.
6. To apply statistical physics in three main distributions.
7. To analyze the relation between molar specific heat and degrees of freedom in gas molecules.
8. To analyze the relation between temperature and entropy through T-S diagram.

UNITI: KINETIC THEORY O F GASES **18 Hrs**

Introduction- concepts of ideal gas-Postulates of kinetic theory of gases- pressure exerted by gas- Gas equation- Gas laws- Brownian motion-degrees of freedom-Equipartition of energy – relation between molar specific heats and degrees of freedom-specific heats of Mono, Di and polyatomic gas-Behaviour

of specific heat at low temperature- Van der Waals' Equation of State-Estimation of critical constants-mean free path- Clausius expression for mean free path- application to atmospherichysics.

Extra reading/Key words: *Change of pressure with height, Critical point*

UNIT II: THERMODYNAMICS **18 Hrs**

Thermodynamicsystem-Zerothlawofthermodynamic-ThermodynamicEquilibrium-Internal energy-First law of thermodynamics-Significance of the first law-Specific heat of a gas- Carnot's ideal heat engine–Carnot's theorem- Second law of thermodynamics- Internal combustion engine–Entropy – change of entropy in reversible cycle and irreversible process – T-S Diagram–Maxwell's thermodynamic relations–ClausiusandClaypeyronlatentheatequationsusingMaxwell'srelations-Thermodynamicpotentials.

Extra Reading/Keywords: *Energy, State coordinates*

UNIT III: LOW TEMPERATURE PHYSICS **18 Hrs**

Joule's Law for perfect gas- Expression for Joule's Co efficient -Joule-Thomson effect-porous plug experiment: liquefaction of gases- principle of regenerative cooling- Linde's process-principle of cascaded cooling- adiabatic demagnetization-Peltier effect-practical applications of low temperatures: Refrigeration- refrigerating machines- refrigerators -electroflux refrigerator- Co-efficient of performance - Air conditioning machines- Equipment used in air conditioners – classifications: Summer ,Winter, Unitary and Central air conditioners - Criteria for air conditioners - Super fluidity (Qualitative) -Liquid Nitrogen -solid carbon dioxide and its applications (dry ice).

Extra Reading/Keywords: *Temperature of inversion*, *Heat capacity*

UNIT IV:TRANSMISSION OFHEAT **18 Hrs**

Introduction-Transmission of heat-Thermal conductivity – Rectilinear flow of heat–experimental methods to determine the coefficient of thermal conductivity– Forbes's methodand Lee's disc method – Kirchoff's law, Stefan's law and Newton's law of radiation – Blackbody radiation – Energy distribution in the black body spectrum- Rayleigh Jean's formula – Wien's law – Planck's radiation formula - Solar constant- Angstrom's Pyrheliometer - temperature of the Sun-applications of conduction, convection and radiation.

Extra Reading/Keywords: *Conduction, Heat transfer*

UNIT V: STATISTICALPHYSICS **18Hrs**

Introduction-probability-principle of equal a priori probability-permutations and combinations-thermodynamic probability-microstate and macrostate-constraints on a system-Ensemble and average properties-fundamental postulates of statistical mechanics-statistical Ensembles–micro canonical, canonical and grand canonical ensembles –three kinds of particles-Basics of Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein distribution.

Extra Reading/Key words: *Degenerate gases, photon gas*

TEXT BOOKS

1. Brijlal and Subramaniam, Heat, Thermodynamics and Statistical Physics, S. Chand& Co. New Edition (2012).
2. S.C. Garg, R.M. Bansal, C.K. Ghosh, Thermal Physics: with Kinetic Theory, Thermodynamics and Statistical Mechanics, McGraw Hill, (2020).
3. R.B. Singh , Thermal and Statistical Physics, New Age International Private Limited, (2020).
4. Dr. Priyanka Kanwal, Ravi Kant Sharma, Dr. Balbir Kumar, Thermal Physics & Statistical Mechanics, S Vinesh& Co. (2020).
5. K.K. Pathak, Poppy Hazarika, Thermal Physics, Vishal Publishing Co.(2020).

SUGGESTED READINGS

1. F.Reif, Fundamentals of Statistical and Thermal Physics, Sarat Book House (2010).
2. Mark Zemansky, Richard Dittman, Heat and Thermodynamics, McGraw Hill, (2017).
3. Herbert B Callen, Thermodynamics and An Introduction to Thermostatistics, Wiley (2006).
4. D. Jeyaraman. Dr.K. Ilangovan and S. Visvanathan, Thermal Physics & Statistical Mechanics,(2009).

WEB REFERENCES

1. https://www.clearniitmedical.com/2019/05/physics-notes-kinetic-theory-of-gases.html.
2. http://astro1.panet.utoledo.edu/~khare/teaching/phys2130h-spring-2008/notes/chapter19-svk.pdf.
3. https://www.khanacademy.org/science/physics/thermodynamics.
4. https://www.livescience.com/50776-thermodynamics.html.
5. https://www.kanchiuniv.ac.in/phy/THERMAL%20PHYSICS%20MATERIAL_KR.pdf.
6. https://ocw.mit.edu/courses/physics/8-333-statistical-mechanics-i-statistical-mechanics-of-particles-fall-2013/lecture-notes/.
7. https://nptel.ac.in/courses/112/108/112108149/.

COURSE OUTCOMES:

The Learner will be able to:

Cos	CO Description	Cognitive Level
CO1	Remember the basic ideas on properties of gas, laws of thermodynamics, the low temperature physics, heat transmission and thermodynamic probability.	K1
CO2	understand the concepts of kinetic theory of gases, working of Heat Engines, the concepts on low temperature physics and different heat transmission mechanism and basics of statistical Physics.	K2
CO3	Apply the concepts of kinetic theory of gases in atmosphere physics, laws of thermodynamics in Carnot's heat engine and Internal combustion engine, low temperature physics in refrigerating machines, air conditioning machines, real time applications of conduction, convection and radiation and statistical physics in three main distributions.	K3
CO4	analyze the relation between molar specific heat, degrees of freedom in different kinds of gas molecules, temperature and entropy via T-S diagram, different modes of heat transmission mechanism and compare the three statistical distributions.	K4

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	**H**	**H**	**M**	**H**	**H**	**H**	**H**	**H**	**H**
CO 2	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**
CO 3	**H**	**H**	**H**	**M**	**H**	**H**	**H**	**H**	**H**
CO 4	**H**	**H**	**H**	**M**	**H**	**H**	**H**	**H**	**H**

	PSO1	PSO2	PSO3
CO 1	**H**	**M**	**M**
CO 2	**H**	**H**	**M**

CO 3	**H**	**H**	**H**
CO 4	**H**	**H**	**H**

CO - PSO Mapping

(For Candidates admitted in the Academic year 2022-2023)

Course Title	**MAJOR CORE 5: MECHANICS**
Code	**U22PH2MCT05**
Course Type	**Theory**
Semester	**II**
Hours/ Week	**5**
Credits	**4**
Marks	**100**

CONSPECTUS:

To understand the basic principles and concepts of Mechanics, rigid body dynamics, central force motion, conservation laws, oscillations and Relativity.

COURSE OBJECTIVES:

1. To recall the Moment of Inertia and conservation laws.

2. To understand the concept of rigid bodies dynamics.

3. To understand the motion of a particle under a central force field.

4. To understand the mathematical concepts to explain harmonic oscillation.

5. To analyze the theory and significance of space, mass and time on the basis of Einstein's concepts.

6. To analyze the concepts with the applications and employ those skills to solve Problems

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UNIT I: DYNAMICS OF RIGID BODIES **15 Hrs**

Moment of Inertia (M.I)- Radius of Gyration- Perpendicular and Parallel axis Theorems of M.I - M.I of a circular disc, solid cylinder, hollow cylinder- M.I of a Flywheel- Kinetic energy of a rotating body- M.I of a diatomic molecule - centre of mass

Extra Reading / Keywords: *Euler's equation of Rigid body motion, Rotational energy state of a rigid diatomic molecule*

UNIT II: CENTRAL FORCE MOTION **15 Hrs**

Motion of a particle under a central force field- two body problem - Reduction of two body problem to one body and it's solution- Differential equation of motion with central force and it's solution- energy equation- energy diagram - Kepler's laws - satellite in circular orbit and applications, Geosynchronous orbits.

Extra Reading / Keywords: *Global Positioning System (GPS)*

UNIT III: CONSERVATION LAWS **15 Hrs**

Laws of conservation of Linear momentum for a particle - collision between two bodies - Inelastic and elastic Collision in one dimension - angular momentum - relation between angular momentum and torque- conservation of angular momentum- conservation of energy

Extra Reading / Keywords: *Law of conservation of Linear momentum for a system of particles*

UNIT IV: OSCILLATIONS **15 Hrs**

Periodic and simple Harmonic Motion- Differential equation for Simple Harmonic Oscillator and it's general solution- Energy of Harmonic Oscillator- Average values of Kinetic and Potential energies of a harmonic Oscillator - Superposition of two or more Simple Harmonic Oscillators- Damped and Forced Oscillators- Resonance.

Extra Reading / Keywords: *Simple pendulum, Compound pendulum*

UNIT V: SPECIAL THEORY OF RELATIVITY **15 Hrs**

Galilean - Newtonian relativity- Galilean transformations- Michelson Morley experiment and it's importance - Einstein's Postulates- Lorentz transformatios and it's interpretation- consequence of Lorentz transformation - Length Contraction- time dilation - relativistic addition of velocities - Mass energy equivalence - Basic ideas of general theory of relativity

Extra Reading / Keywords: *Einstein gravity, Speed of light*

TEXT BOOKS

1. Mathur D.S, P S Hemne, Mechanics, S. Chand & Co., 12th edition (2014).
2. N.Subrahmanyam BrijLal, Waves and Oscillations, Vikas Publishing House PVT Ltd., New Delhi2nd edition (2018).
3. J. C. Upadhyaya, Mechanics, Ram Prasad Publications, Agra 1st edition (2017)

SUGGESTED READINGS

1. Keith R. Simon, Mechanics, Addison-Wesley Publishing Company, 3rd edition(2016)
2. R.N. Chaudrey, Waves and Oscillations, New Age International Publishers2nd edition (2018).
3. D.Halliday, R.Resnick and J.Walker, Fundamentals of Physics, Wiley, NY, 6th edition (2021).

WEB REFERENCES

1. https://oyc.yale.edu/physics/phys-200/lecture-9
2. https://chem.libretexts.org/Courses/Oregon_Institute_of_Technology
3. https://www.austincc.edu/mmcgraw/files_2425/Chap_15Ha-Oscillations.pdf
4. http://physics.mq.edu.au/~jcresser/Phys378/LectureNotes/VectorsTensorsSR.pdf
5. https://link.springer.com/chapter/10.1007/978-3-030-15195-9_9

COURSEOUTCOMES:
The Learner will be able to:

COs	CO Description	Cognitive Level
CO 1	Recall the concept of moment of Inertia, central force motion, Conservation laws, oscillations and relativity.	K1

CO 2	understand the moment of inertia of different shapes of body, relation between angular momentum and torque, explain the motion of a particle in a central force field, explain the theory of damped and forced oscillation, interpret Lorentz transformation equations and the importance of mass energy equivalence.	K2
CO 3	apply physics principles learnt such as moment of inertia differential equations of motion, Conservation of angular and linear momentum, simple harmonic motion, Time dilation, Length contraction and to solvepractical problems.	K3
CO 4	analyze the importance of moment of inertia, central force motion in satellites, conservation laws, application of oscillations and the relativistic concept of mass, length and time.	K4

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	H	M	M	L	M	H	M	L
CO 2	H	M	H	M	L	M	M	M	L
CO 3	H	H	H	L	M	M	M	H	M
CO 4	H	H	H	M	M	H	H	H	M

CO - PSO Mapping

	PSO1	PSO2	PSO3
CO 1	H	M	M
CO 2	H	H	M
CO 3	H	H	H
CO 4	H	H	H

(For Candidates admitted in the Academic year 2022-2023)

Course Title	**INDUSTRIAL RELATIONS: PHOTOVOLTAIC SYSTEMS**
Code	**U22PH2IRT01**
Course Type	**Theory**
Semester	**II**
Hours/Week	**1**
Credits	**1**
Marks	**100**

UNIT I: RENEWABLE ENERGY SOURCES (3 Hrs)

Introduction to Renewable energy-Types of renewable energy-Energy: Introduction to solar energy - Solar Energy conversion and efficiency.

UNIT II: SOLAR PHOTOVOLTAIC SYSTEMS (3 Hrs)

Introduction to solar cells-Types of solar cells, function and characteristic of solar cells- Spectral power distribution of solar radiation-Solar PV systems.

Classification of solar cells- Modules and arrays-solar cells in series and parallel connection- Solar panel –series and parallel.

UNIT III: INSTALLATION (3 Hrs)

Solar on-grid, off-grid, hybrid system- Merits and demerits - Introduction to Max. Power Point Tracking (MPPT) charger and its working principle-Solar batteries - accumulator solid cells, high performance cells (polymer, fibre solar cells)-Parallel and series connection – Invertors Convertors and synchronizers.

UNIT IV: SOLAR ENERGY APPLICATIONS (3 Hrs)

Solar thermal system-Solar water heater and its types-Function and uses of solar water heater in domestic and industries-Procedure for installing solar water heater.

UNIT V: INSTALLATION DESIGN & EVALUATION OF SOLAR SYSTEM (3 Hrs)

Calculation of solar system for the project-Bi directional Energy (Watt/hour) meter and its uses-Structural design of installing panels-Protection devices for panels-Earthing-Testing of solar panels-Switch ON and OFF- procedure for On grid and Off grid solar systems-carbon offset calculation.

BOOK FOR STUDY

1. G D Roy, Non conventional energy resources Khanna Publishers, 1873.
2. Arvind Tiwari, G. N. Tiwari, Shyam, Hand Book of Solar Energy: Theory, Analysis and Applications, Springer, Singapore, 2016.
3. https://www.yourarticlelibrary.com/Application of Solar Energy.
4. Krauter, Stefan C. W., Solar Electric Power Generation - Photovoltaic Energy Systems, Springer-

Verlag Berlin Heidelberg, New Delhi, 2006.

5. Mellit, Adel, Benghanem, Mohamed (Eds.), A Practical Guide for Advanced Methods in Solar Photovoltaic Systems, Springer International Publishing, 2020.
6. E resources: Solardirect.com

(For Candidates admitted in the Academic year 2022-2023)

Course Title	**Allied Physics 3: Basic Physics – II** (for Chemistry)
Code	**U22PH2ALT04**
Course Type	**Theory**
Semester	**II**
Hours/Week	**4**
Credits	**2**

Marks	100

CONSPECTUS

To make the students study the basic concepts of Electromagnetism, Lasers, Analog and Digital electronics, wave mechanics.

Course Objectives

1. To understand the electromagnetism principles and their applications.
2. To understand the concepts of Analog electronics and its applications.
3. To create the appropriate truth tables from a description of a combinational logic functions and understand the rules of Boolean algebra.
4. To analyse the basic principles of lasers and understand the various types of Laser.
5. To understand the importance of quantum mechanics over classical mechanics.

UNIT I: ELECTROMAGNETISM **12 Hrs**

Laws of electromagnetic induction-determination of magnetic field due to circular coil-self and mutual induction- self inductance of a solenoid - mutual inductance of a co-axial solenoid inductor – co-efficient of coupling- determination of self-inductance by Anderson's method - experimental determination of mutual inductance - experimental determination of horizontal intensity of earth's magnetic field using circular coil

Extra Reading / Keywords: *Surface charge density, Potential difference, Torque, Magnetic field*

UNIT II: ANALOG ELECTRONICS **12 Hrs**

Semiconductors - Types of semiconductors - PN junction diode - V-I characteristics of junction diode - Junction diode as a rectifier (full wave Bridge rectifier) - Zener diode characteristics - Zener diode as a regulator - Transistor- Transistor action- Characteristics of transistor (CE Mode)

Extra Reading / Keywords: *Breakdown, Operational amplifier*

UNIT III: DIGITAL ELECTRONICS **12 Hrs**

Logic gates-construction of AND, OR & NOT gates using discrete components - NAND and NOR gates - Universal building blocks - De Morgan's theorem - Boolean algebra- Simplification of Boolean expressions (up to 3 variables) - Half adder - Full adder - Half subtractor.

Extra Reading / Keywords: *Mutual conversion, Logic operations*

UNIT IV: LASER **12 Hrs**

Interaction of light and matter - Spontaneous and stimulated emission- metastable state - Population inversion - Pumping methods: optical pumping, chemical pumping, electrical pumping, X - ray pumping - Characteristics of laser - Types of lasers - Nd :YAG Laser - CO_2 - Applications of lasers in medicine and industry

Extra Reading / Keywords: *Photons, Excitation*

UNIT V: WAVE MECHANICS **12 Hrs**

Wave particle duality - De-Broglie wavelength - Davission and Germer's experiment - G.P Thomson experiment - Group and phase velocities - Wave packets - Heisenberg's uncertainty principle - illustration of uncertainty principle.

Extra Reading / Keywords: *Configuration spaces, Uncertainty principle to macroscopic objects, Applicable to real life*

TEXT BOOKS

1. Murugeshan.R, Allied Physics, S. Chand & Co. Ltd, New Delhi (2005).
2. Mehta V.K., Rohit Mehta, Principles of Electronics, New Delhi: S.Chand & Co. Ltd. 10 th edition, New Delhi (2014).
3. Vijayendran. V, Introduction to integrated Electronics, S. Viswanathan Pvt., Ltd. (2011)
4. Dr.M.N.Avadhanulu, Dr.P.S.Hemne, An Introduction Lasers theory and applications, S.Chand and company (2015).
5. Chatwal and Anand, Quantum mechanics, Himalaya Publishing House, 8th Edition (2019).

SUGGESTED READINGS

1. Murugeshan. R, Electricity and Magnetism, S. Chand & Co., New Delhi (2019).
2. Malvino. A and Leach, Digital Principles and Applications, 7th edition, Mc-Graw Hill, New York (2011).
3. David Halliday, Robert Resnik, Kenneta S. Krane, The Physics, John Willeya and sons, Singapore (2005).
4. Ghatak and Thyagarajan , Lasers Theory and application, Macmillan India Ltd.,(1997).
5. Sathya Prakash, Quantum Mechanics, S.Chand and Company, New Delhi (2001).

WEB REFERENCES

1. https://www.britannica.com/science/electromagnetism
2. https://byjus.com/jee/semiconductors/
3. https://web.pdx.edu/~egertonr/ph311-12/wavemech.htm
4. https://www.britannica.com/technology/laser/Laser-applications

COURSE OUTCOMES

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO-1	Recall the principles of electromagnetism and the determination of inductances	K1
CO-2	Explain the working and characteristics of semiconductor diodes and analyze transistor as an amplifier	K2
CO-3	Apply the basic laws, principles of Boolean algebra and logic gates in combinational circuits with their truth tables	K3
CO-4	Outline and illustrate the basic concepts and importance of quantum mechanics over classical mechanics with the experiments and verifications.	K4

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	**H**	**M**	**M**	**M**	**L**	**M**	**M**	**H**	**M**
CO2	**H**	**H**	**H**	**M**	**M**	**M**	**H**	**M**	**H**
CO3	**H**	**M**	**H**	**M**	**M**	**L**	**M**	**M**	**H**
CO4	**H**	**H**	**M**	**M**	**M**	**M**	**M**	**H**	**M**

CO-PSO Mapping

	PSO1	PSO2	PSO3
CO1	**H**	**H**	**M**
CO2	**M**	**M**	**H**
CO3	**M**	**M**	**H**
CO4	**H**	**H**	**H**

(For Candidates admitted in the Academic year 2022-2023)

Course Title	**MAJOR CORE 6: ELECTRICITY AND ELECTROMAGNETISM**
Code	**U22PH3MCT06**
Course Type	**Theory**
Semester	**III**

Hours/Week	**4**
Credits	**3**
Marks	**100**

CONSPECTUS

To study the basic principles and concepts of Electricity and Electromagnetism.

COURSE OBJECTIVES:

1. To recall the basic laws in electricity and electromagnetism
2. To understand the principles of capacitor and working of quadrant electrometer
3. To understand the concepts of electromagnetism
4. To apply the laws of electromagnetic induction to determine the self-inductance of the solenoid and mutual inductance between two long coaxial solenoids
5. To understand the concepts of alternating currents
6. To apply the j-operator method to analyze the a.c. circuits
7. To understand the working of electric generators and motors

UNIT I: ELECTRICITY **12 Hrs**

Coulombs law - electric field - charge distribution - Flux - Gauss's law: applications of Gauss's law in spherical - Cylindrical and Planar symmetry - Electric potential: potential of a localized charge distribution - Potential for a uniformly charged spherical shell and solid sphere - Energy of point charge distribution and continuous charge distribution - Electric field and charge density: inside and on the surface of a conductor - Surface charge and force on a conductor

Extra Reading/Keywords: *Dielectrics, Dissipation factor, Surface charge density*

UNIT II: ELECTROMAGNETISM **12 Hrs**

Force on a current carrying conductor-Fleming's left hand rule - forces between long conductors carrying current - Definition of Ampere - Biot Savart law-Applications: magnetic field along the axis of a circular coil and solenoid - Ampere's circuital law - Applications :magnetic field inside a long solenoid and toroid -Lorentz force on a moving charge - direction of force - force on a current loop in a uniform magnetic field - Electromagnetic Potentials : Magnetic scalar and Magnetic vector potential

Extra Reading/Keywords: *Magnetostatics, Electrodynamics, Potential difference, Torque, Magnetic field*

UNIT III: ELECTROMAGNETIC INDUCTION AND ITSAPPLICATIONS 12 Hrs

Faraday's Laws of Electromagnetic induction-self and mutual induction – experimental determination of self-inductance by Rayleigh's method and Anderson's method-determination of mutual inductance - growth and decay of current in circuit containing C & R and L &R – high resistance by leakage- charging and discharging of a

condenser through L&R - condition for discharge to be oscillatory-Eddy currents- Application of Eddy currents: Electric Brakes- induction coil.

Extra Reading/Keywords: *Transformer*

UNIT IV: ALTERNATING CURRENTS **12 Hrs**

Peak, average and RMS values of alternating current- analysis of AC circuits by j operator method-alternating EMF applied to a circuit containing resistance, inductance and capacitance in series and parallel-series and parallel resonant circuits- sharpness of resonance and Q - factor-power in AC circuits - power factor-wattles current - choke coil

Extra Reading/Keywords: *Sine wave, Modulation*

UNIT V: ELECTRIC GENERATORS AND MOTORS **12Hrs**

Alternating current generator- direct current generator- types of DC dynamos- direct current motor-Brushless DC motor - back e.m.f. of a motor- types of direct current motors-series wound, shunt wound, compound wound motor-efficiency of a motor –rotating magnetic field –induction motor-turbines, pumps, home appliances and motor vehicles.

Extra Reading/Keywords: *Electric power grids, Particle accelerators*

TEXTBOOKS

1. R. Murugesan R, Electricity and Magnetism, 10th Edition, S.Chand and Co., New Delhi(2017).
2. AmbroseandVincentDevaraj, 5th Edition, Introduction to Electronics,(1992).

SUGGESTED READINGS

1. Narayanamoorthy & Nagaratnam, Electricity and Magnetism, NPC, Chennai(1992).
2. Tiwari N.D, Electricity and Electromagnetism, Sultan and Chand Co., New Delhi(1998).
3. Brijlaland Subramaniam, Electricity and Electromagnetism, S.Chand and Co, New Delhi(2000).
4. AroraC.L,Electricity and Magnetism,16th Edition, S.Chand and Co.,NewDelhi,(1999).
5. TewariKK**,** Electricity&Magnetism,3rd Edition, Kindle Edition(2007).

WEBREFERENCES

1. https://byjus.com/physics/electromagnetism/
2. https://www.youtube.com/watch?v=Elv3WpL32UE
3. https://www.animations.physics.unsw.edu.au/jw/electricmotors.html
4. https://www.youtube.com/watch?v=fQcPEeoiUwU
5. https://www.toppr.com/guides/physics/magnetic-effects-of-electric-

6. current/electromagnetic-induction-and-its-applications/

COURSEOUTCOMES:

The Leaner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO1	Recall the fundamental laws in electricity and electromagnetism	K1
CO2	Understand self and mutual induction, choke coil & working of generators and motors	K2
CO3	Apply Gauss law to spherical and cylindrical bodies, the principle of eddy current to electric brakes and the principle of rotating magnetic field to induction motor.	K3
CO4	Analyze the concepts of electricity and electromagnetism to Solve the real time problems.	K4
CO5	Evaluate the efficiency of electrical appliances by applying the concept of electromagnetic induction.	K5

PO–CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	**H**	**M**	**H**	**H**	**L**	**L**	**H**	**M**	**H**
CO-2	**H**	**M**	**H**	**H**	**L**	**L**	**H**	**H**	**H**
CO-3	**H**	**H**	**H**	**H**	**L**	**L**	**H**	**M**	**H**
CO-4	**H**	**H**	**H**	**H**	**L**	**L**	**H**	**M**	**H**
CO-5	**H**	**H**	**M**	**L**	**L**	**L**	**H**	**H**	**H**

PSO–CO MAPPING

CO/PSO	PSO1	PSO2	PSO
CO-1	**H**	**H**	**H**
CO-2	**H**	**H**	**M**
CO-3	**H**	**H**	**M**
CO-4	**H**	**H**	**H**
CO-5	**H**	**M**	**H**

(For Candidates admitted in the Academic year 2022-2023)

Course Title	**MAJOR CORE 7: MAIN PRACTICAL II–OPTICS, ELECTRICITY AND ELECTRONICS PRACTICALS**
Code	**U22PH3MCP07**
Course Type	**Practical**
Semester	**III**

Hours/Week	**6**
Credits	**4**
Marks	**100**

CONSPECTUS:

To understand the basic laws of optics, electricity and electronics through experiments.

COURSEOBJECTIVES:

1. To understand the basic laws of optics by doing simple experiments with prism and grating.
2. To apply the concepts of polarization in measuring specific rotator power of sugar solution using polarimeter.
3. To apply the basic concepts of electricity by doing experiments using Resonant circuits.
4. To analyze the characteristics and applications of electronic devices such as diodes and transistors.
5. To understand the basic knowledge of electronics by operating an OPAMP.

LIST OF EXPERIMENTS:

1. Determination of specific rotatory power of sugar solution using polarimeter.
2. Determination of wavelength of spectral lines using a grating-normal incidence.
3. Determination of refractive index of the material of a prism– i-d curve.
4. Study of Series and Parallel Resonant Circuits.
5. Determination of the parameters–Frequency, Voltage peak, Vrms, Instantaneous Value, Peak Factor and Form Factor of sine waveform.
6. Study of Characteristics of a Zener diode.

7. Construction and study of Regulated Power Supply using Zener Diode.
8. Study of transistor characteristics–common base configuration.
9. Study of transistor characteristics–common emitter configuration.
10. Construction and study of Half wave rectifier with and without filter.
11. Construction and study of Full wave rectifier with and without filter.
12. Construction and study of Inverting and Non-inverting Amplifier using OP-AMP.
13. Construction and study of summing and Difference Amplifier using OP-AMP.
14. Construction and study of Differentiator and Integrator using OP-AMP.
15. Determination of dispersive power of a prism.
16. Determination of refractive index of liquid using hollow prism.

SUGGESTED READINGS

1. Ouseph C .C. Rao U.J,. Vijayendran. V, P ractical Physics and Electronics, S.Viswanathan (Printers and Publishers),Pvt.,Ltd.,FirstEdition2007.

WEBREFERENCES:

1. http://ov-au.vlabs.ac.in/optics/Diffraction_Grating/experiment.html
2. http://vlabs.iitkgp.ernet.in/be/exp10/zenercharac.html
3. http://vlabs.iitkgp.ernet.in/be/exp10/znrli_ver1.html
4. http://vlabs.iitkgp.ernet.in/be/exp11/index.html
5. http://vlabs.iitkgp.ernet.in/be/exp12/index.html#
6. http://vlabs.iitkgp.ernet.in/be/exp17/index.html#
7. http://vlabs.iitkgp.ernet.in/be/exp18/index.html

Course Outcomes:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO-1	Gain practical knowledge by applying the concepts of optics, Electricity and electronics	K1
CO-2	Understand the properties of light by measuring the specific rotator power, refractive index of the material of the prism and wavelength of the light used through grating and characteristics of electronic devices by measuring the self-inductance of the coil, Ripple factor of the rectifiers and basic operations of an OPAMP.	K2
CO-3	Apply the different configuration modes of transistor to determine the transistor parameters and the characteristics of OPAMP to construct OPAMP as adder, subtractor, differentiator and integrator	K3
CO-4	Analyze the characteristics of electronic devices such as diodes and transistors.	K4
CO-5	Evaluate the various characteristic parameters of optical, electrical and electronic devices.	K5

PO–CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	**H**	**H**	**H**	**M**	**M**	**H**	**H**	**H**	**M**
CO-2	**H**	**M**	**H**	**M**	**M**	**H**	**H**	**H**	**H**
CO-3	**H**	**M**	**M**	**M**	**M**	**H**	**H**	**M**	**H**
CO-4	**H**	**M**	**M**	**M**	**M**	**H**	**H**	**M**	**H**
CO-5	**H**	**M**	**H**	**M**	**M**	**H**	**H**	**H**	**H**

PSO–COMAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	**H**	**H**	**H**
CO-2	**H**	**H**	**M**
CO-3	**M**	**H**	**H**
CO-4	**M**	**H**	**H**
CO-5	**H**	**H**	**H**

(For Candidates admitted in the Academic year 2022-2023)

Course Title	Allied Physics Paper 1: Properties of Matter, Optics and Sound
Code	U22PH3ALT05
Course Type	Theory
Hours/Week	4 Hrs /Wk
Credits	2
Marks	100

CONSPECTUS

To understand the properties of matter and appreciate how the relevant theories find application in various devices, the modes of transfer of heat and the methods of achieving low temperature and to understand the nature of simple harmonic motion, sound and the basic principles of optics.

COURSE OBJECTIVES

1. To remember the basic concepts of stress, strain, internal force and equilibrium in solids.
2. To understand, Bernoulli's theorem, Poiseuille's formula and laws of diffusion and osmosis.
3. To understand conduction, convection and radiation in thermal physics.
4. To apply physics principle and to study the behavior of light from optics.
5. To understand the nature of simple harmonic motion and its applications and the importance of sound parameters.

UNITI: VISCOSITY, DIFFUSION AND OSMOSIS 12Hrs

Viscosity- coefficient of viscosity- Streamlined motion and turbulent motion - Poisuelle's formula- experiment to determine viscosity by Stoke's method - Bernoulli's theorem -venturimeter Diffusion- Graham's laws of diffusion- Fick's law-coefficient of diffusion - determination of coefficient of diffusion- Osmosis- Osmotic pressure- experimental determination of osmotic pressure -Laws of osmotic pressure.

Extra reading / Key words: *Molasses, Lubricants, Turgor pressure, Dialysis*

UNIT II: THERMAL PHYSICS 12Hrs

Newton's law of cooling- verification of Newton's law of cooling- specific heat capacity of a liquid by cooling- Specific heat capacities of gases- Mayer's relation. Transmission of Heat - Co-efficient of Thermal Conductivity - applications of conduction of heat -convection -applications of convection-properties and applications of Radiations - Stefan's law. Porous plug experiment - JK effect - Theory – Inversion Temperature.

Extra reading / Key words: *Infrared radiation, Condensation*

UNIT III: ELASTICITY **12Hrs**

Stress and Strain - Hooke's law - Moduli of Elasticity - Poisson's Ratio - relation between the elastic moduli-Bending of Beams - Bending Moment - Cantilever (pin and microscope) - Uniform Bending (optic lever method) - Rigidity modulus: static torsion - Couple per unit twist-work done - Surface tension- determination of surface tension (drop weight method).

Extra reading / Key words: *Elastomers, Fracture mechanics*

UNITIV: OPTICS **12Hrs**

Refraction - Refraction through prism- Refractive index - Interference - Condition for Interference - Newton's rings - Air wedge - Diffraction - theory of grating - difference between prism and grating spectrum- Determination of wavelength of light using transmission grating(Normal incidence)- LASER principles- He-Ne Laser- Applications of laser in Medicine and Industry.

Extra reading / Key words: *Deviation, Duality, Polarization, Photon excitation*

UNITV: SOUND **12Hrs**

Simple Harmonic Motion - Angular velocity - Angular acceleration - Uniform circular motion - centrifugal force – Centrifuge. Characteristics of sound waves - Amplitude, pitch, frequency and loudness - Acoustics of buildings - Reverberation - Reverberation time - Sabine's formula - Condition for good acoustics - Ultrasonics – Introduction – Production- Properties- Applications.

Extra reading / Key words: *Musical note, Echo, Decibel meter*

COURSE OUTCOMES
The Leaner will be able to:

Course Outcomes		Cognitive Level
CO -1	recall and enumerate the properties of matter, heat, optics, sound.	K1
CO-2	understand the fundamental concepts of properties of matter, modes of transfer of heat, principles of optics, nature of simple harmonic motion and characteristics of sound.	K2
CO-3	apply Physics principles such as bending of beams, viscosity, surface tension, transfer of heat, diffraction, interference of light, simple harmonic motion and reverberation to explain the natural physical processes and related technological advances.	K3
CO-4	analyze the real time problems employing Physics principles along with elementary Mathematics	K4

TEXTBOOKS

3. Murugeshan R., Allied Physics, S. Chand & Co. Pvt. Ltd., New Delhi(2014).

4. Murugeshan R., Properties of Matter, S. Chand & Co. Pvt. Ltd., New Delhi(2017).
5. Brijlal and Subramanyam N., Hemne P. S., Heat, Thermodynamics and Statistical Physics, Revised Edition, S. Chand & Company Ltd, New Delhi(2012).
6. Subramanyam N., Brijlal and Avadhanulu M. N., Text Book of Optics, Revised Edition S. Chand & Co, New Delhi(2012).
7. Murugeshan R., Mechanics and Mathematical Physics, 3rd Edition, S. Chand & Co, New Delhi,(2017).

SUGGESTED READINGS

1. Murugeshan R and Kiruthiga Sivaprasath, Properties of matter and Acoustics, 2nd Edition, S. Chand & Company Ltd, New Delhi,(2012).
2. Rajam J. B., and Arora C.L. A Text Book of Heat andThermodynamics, S. Chand & Co, New Delhi (1983).
3. M. Narayanamoorthy and N. Nagarathinam, Heat, The National Publishing Co., Chennai(2005).
4. Murugeshan R., and Krithiga Sivaprasath, Optics and spectroscopy, Revised Edition, S. Chand & Co, New Delhi(2010).
5. Mathur D. S., Mechanics, Revised Edition, S. Chand & Co., New Delhi(2012).

WEBREFERENCES

1. www.phys.Libretexts.org
2. www.encyclopedia.com
3. www.studyweb.com

PO–CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	H	H	M	M	H	H	H	M
CO-2	H	M	H	M	M	H	H	H	H
CO-3	H	M	M	M	M	H	H	M	H
CO-4	H	M	M	M	M	H	H	M	H
CO-5	H	M	H	M	M	H	H	H	H

PSO–COMAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	H
CO-2	H	H	M
CO-3	M	H	H
CO-4	M	H	H
CO-5	H	H	H

(For Candidates admitted from June 2022 onwards)

Course Title	**ALLIED PHYSICS PAPER 1: DIGITAL ELECTRONICS AND MICROPROCESSOR (For B. Voc. SD)**
Code	**U22PH3ALT06**
Course type	**Theory**
Semester	**III**
Hours/Week	**4**
Credits	**2**
Marks	**100**

CONSPECTUS

The course covers fundamental concepts of digital Electronics such as number systems, logic gates, Boolean algebra, simplification of Boolean expressions, sequential circuits and basics of microprocessor INTEL 8085.

COURSE OBJECTIVES

1. To understand the different number systems, their conversions and function of basic logic gates.
2. To simplify the Boolean expression using karnaugh map and implement it using gate networks.
3. To apply the sequential logic circuits to shift registers and counters.
4. To understand the various parts of microprocessor in architecture of INTEL 8085
5. To write simple programs using the instruction set of INTEL 8085.

UNIT I: DIGITAL FUNDAMENTALS 12 Hrs

Number systems and codes: Decimal, binary, octal and hexa decimal number systems - Codes: ASCII code -BCD code - Basic logic gates: AND, OR, NOT, NAND & NOR gates - NAND and NOR as universal gates.

Extra reading / Key words: Gray code, Excess-3 code

UNIT II: BOOLEAN EQUATIONS AND SIMPLIFICATION 12 Hrs

Boolean Algebra- De Morgan's theorems-verification using truth tables- simplification of Boolean equations: Sum-of-Products Method - Karnaugh Map - Pairs, Quads, and Octets- Karnaugh Simplifications up to four variables- Don't-care Conditions.

Extra reading / Key words: *Max term, Product of sum*

UNIT III: SEQUENTIAL CIRCUITS 12 Hrs

Flip flops: SR Flip flop - Clocked SR Flip flop - D Flip flop- JK Flip flop and T Flip flop Registers : Shift Left and Shift Right registers- Parallel shift registers - Counters :-Asynchronous (Ripple) counters-Synchronous counters-Timing sequence.

Extra reading / Key words: *PISO, BCD Counter*

UNIT IV: ARCHITECTURE AND INSTRUCTION SET OF INTEL 8085 12 Hrs

General Architecture of microcomputer-Architecture of INTEL 8085- Instruction word size - Instruction and data formats - Addressing modes –Data transfer group-Arithmetic group- Logical group- Branch group -Stack, /O and machine control group.

Extra Reading / Keywords: *Credit card processing, Instrumentation*

UNIT V: PROGRAMMING OF MICROPROCESSOR 12 Hrs

Assembly language simple programs - Shifting 8 bit number left by 1 bit - Shifting 8 bit number left by 2 bits - addition of two 8 bit numbers (with and without carry - subtraction of two 8 bit numbers - finding smallest / largest element of an integer array- sum of a series of 8 bit numbers.

Extra Reading / Keywords: *Arranging numbers in ascending order, Multiplication*

TEXT BOOKS

1. Vijayendran V. Introduction to Integrated Electronics Digital and Analog, S. Viswanathan (Printers & Publishers) Pvt., Ltd, 1st Edition (2009).
2. Floyd, Digital Fundamentals, Pearson Education, India, 11thEdition(2018).
3. Jain R. P., Modern Digital Electronics, Tata McGraw - Hill Education, New Delhi, 4th Edition (2010).
4. Ram B. Fundamentals of Microprocessors and Microcomputer, Dhanapat Rai Publications (P) Ltd, New Delhi 8thEdition(2013).

SUGGESTED READINGS

1. William H. Gothmann, Digital Electronics- An Introduction to theory & Practice, Prentice Hall of India 2ndEdition(2012).
2. Malvino. A and Leach, Digital Principles and Applications, Mc-Graw Hill, New York, 8th Edition (2015).
3. Nagoor Kani A., 8085 Microprocessor and its Applications, Third Edition Mc graw- hill Publications, Chennai (2017).
4. 2. Dr. D.K. Kaushik. An Introduction to Microprocessor 8085. Dhanapat Rai Publishing Company. (2010)

WEB REFERENCES

1. http://www.ee.surrey.ac.uk/Projects/CAL/digital-logic/gatesfunc/index.html
2. https://cnx.org/contents/UZM3jSVd@4.19:EH8URZWF@1/Simplification-of- Boolean Expressions
3. https://www.tutorialspoint.com/computer_logical_organization/combinational_circuits.m
4. https://www.electronics-tutorials.ws/sequential/seq_1.html
5. https://archive.nptel.ac.in/content/storage2/courses/106108100/pdf/Lecture_Notes/LNpdf
6. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SEC1310.pdf

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level
CO-1	recall the basic knowledge of binary number systems, basic logic gates, laws of Boolean algebra, De Morgan's theorem, flip flops and architecture of microcomputer.	K1
CO-2	understand the fundamentals of conversion of number systems, NAND and NOR as universal gates, explain sequential circuits and architecture and instruction set of INTEL 8085.	K2
CO-3	apply various conversion techniques involved in code conversion, K – mapping, working of shift registers, flip flops, counters and simple programs using INTEL 8085.	K3
CO-4	analyze the sequential circuits and simplification of logical expressions using Boolean algebra and K-mapping and the different addressing modes of Intel 8085.	K4
CO-5	evaluate the operations of higher order logic gates using basic gates, timing sequence of counters and the instructions of 8085 to write the programs on shifting of numbers.	K5

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	**H**	**M**	**M**	**H**	**H**	**H**	**H**	**H**	**H**
CO-2	**H**	**M**	**M**	**H**	**H**	**M**	**H**	**H**	**H**
CO-3	**H**	**M**	**M**	**H**	**H**	**H**	**H**	**H**	**H**
CO-4	**H**	**H**	**M**	**H**	**H**	**M**	**H**	**H**	**H**
CO-5	**H**	**H**	**M**	**H**	**H**	**H**	**H**	**H**	**H**

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	**M**	**H**	**H**
CO-2	**M**	**H**	**H**
CO-3	**M**	**H**	**H**
CO-4	**M**	**H**	**H**
CO-5	**H**	**H**	**H**

(For Candidates admitted in the Academic year 2022-2023)

Course Title	Allied Physics: Biophysics (for Biotech & Bioinformatics)
Code	U22PH3ALT07
Course Type	Theory
Hours/Week	4
Credits	2
Marks	100

CONSPECTUS

In this course the student studies about the physical concepts and techniques to address problems in biology. The course aims to provide students with an advanced integrated knowledge and understanding of core topics.

COURSEOBJECTIVES

1. To understand the basics of atoms and molecular structure.
2. To understand the basic concepts of thermodynamics.
3. Tounderstandthehydrodynamictechniquesandtheirapplicationinbiologicalsystems.
4. To analyze the optical techniques applied to biological system.
5. To analyze the basic principles and theoretical modeling of bio molecular systems.

UNIT I: ATOMIC AND MOLECULAR STRUCTURE 12Hrs

Structure of atom -Concept of bonding: valence of Carbon-hybridizations of carbon- molecular orbital, polar & non polar molecules- Ionic, covalent, Hydrogen, Electrostatic, Disulphide& peptide bonds, Van-der Waals forces- Bond lengths & Bond energies, Bond angles- weak interactions- dipole-dipole interactions.

Extra Reading/Keywords: *Molecular geometry and molecular interactions*

UNIT II: THERMODYNAMICS 12Hrs

Laws of thermodynamics, activation energy. Biological systems as open, non-equilibrium systems, Concept of free energy, unavailable energy and entropy, heat content of food, bomb calorimetry, Enthalpy, Negative entropy as applicable to biological systems. thermodynamics of passive and active transport.

Extra Reading /Keywords: *Biological clock and chemical process in biological organism*

UNIT III: OPTICAL TECHNIQUES 12Hrs

Introduction-defects of eye and its rectification using lenses-microscope: principle, design, resolution, numerical aperture, care and maintenance of microscopes-types of microscopes-Polarization of light, optical activity and its measurement, specific rotation, molar rotation, optical activity of some bio molecules and its significance.

Extra Reading /Keywords: *Magnification and Eyepieces*

UNIT IV: HYDRODYANAMIC TECHNIQUES 12Hrs

Concept of sedimentation: Basic principles and Forces involved- Centrifugal and Relative Centrifugal Force, Centrifugation Techniques- principle, design, types and applications of different Centrifuges.

Viscometry: General features of fluid flow-factors affecting viscosity-Fick's law, determination of coefficient of viscosity, Oswald's viscometer, applications of viscometry in biomolecular structure determination, diffusion in biological systems.

Extra Reading /Keywords: *Separation of blood components and Ultra-centrifuges*

UNIT V: THEORETICALMODELINGOFBIOMOLECULARSYSTEMS 12Hrs

Basic principles of modeling, modeling by energy minimization technique, concept of rotation about bonds, energy minimization by basic technique for small molecules, calculating the potentials, constructing an intermolecular potential, basic principle of molecular dynamics with an example, Ramachandran plot.

Extra Reading /Keywords: *Protein structures and Protein folding*

TEXTBOOKS

1. Murugeshan,RandKiruthigaSivaprasath,OpticsandSpectroscopy,S.ChandandCompany,Ltd.(2010)
2. Brijlal & Subramaniam Heat Thermodynamics and Statistical Physics - S. Chand & Co.New Edition(2012)
3. C. R. Cantor and P.R. Schimmel, Biophysical Chemistry, WAFreeman and Co, Oxford(1980)
4. DaanFrenkelandBerendSmit"UnderstandingMolecularSimulationFromAlgorithmstoApplications", Academic Press, Inc. Orlando,FL,USA,2001.

SUGGESTED READINGS

1. Subramaniyam N, Brijlal and Avadhanulu.M.N, A Text Book of Optics S.Chand and Company, Ltd (2012).
2. Pranab Kumar Banerjee, Introduction of Biophysics, S. Chand and Company, Ltd (2014).
3. F.Reif, Fundamentals of Statistical and Thermal Physics (Waveland Press, 2009).
4. L. Stryer, Biochemistry, W.A. Freeman and Co (1981).

COURSE OUTCOMES

The learners will be able to:

CO's	CO description	Cognitive Level
CO1	Recall the basic concepts of atoms, molecules, bonds, thermodynamics, optical and hydrodynamic properties.	K1
CO2	Explain the working of calorimeter, viscometer, microscope and explain the principles of molecular dynamics.	K2
CO3	Apply the optical and hydrodynamic techniques to biological systems.	K3
CO4	Analyze the thermodynamic properties, optical and hydrodynamic techniques to biological systems.	K4
CO5	Evaluate the modeling mechanism and molecular dynamics to biological systems.	K5

PO – COMAPPING

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

PSO – CO MAPPING

	PSO1	PSO2	PSO3
CO1	**H**	**M**	**L**
CO2	**H**	**H**	**H**
CO3	**M**	**H**	**M**
CO4	**H**	**H**	**H**
CO5	**H**	**H**	**H**

(For Candidates admitted in the Academic year 2022-2023)

Course Title	Major Elective 1: Domestic Power Generation and House Wiring
Code	U22PH3MET01
Course Type	Theory
Hours/Week	4
Credits	3
Marks	100

CONSPECTUS

In this course the student studies about the power generation, power distribution, tools and equipment required for different types of wiring systems & Safety precautions.

COURSE OBJECTIVES

1. To understand and apply the concepts of power generation.
2. To understand, apply, and analyze the concepts of transformer and power distribution.
3. To understand different Wiring Accessories, tools and materials.
4. To understand different types of wires and wiring systems.
5. To understand and apply the different types of Protective Devices and safety precautions in real time.

UNIT I: POWER GENERATION **12 Hrs**

Sources of Energy: Renewable Energy sources and Non Renewable Energy sources– Methods and Generation of Electrical power: Hydel Energy, Thermal Energy, Solar Energy, Biogas Energy and Wind Energy - Energy conservation: Principles of energy conservation, Different energy conservation appliances - Planning for Home Renewable Energy Systems.

Extra Reading / Keywords: *Hydrogen Economy, Hybrid Electric Vehicles*

UNIT II: TRANSFORMER AND POWER DISTRIBUTION **12 Hrs**

Transformer: Definition, Principle, Construction, Applications and Limitations - **Types of Transformers** based on its Phases, Core, Voltage Conversion, Windings and Insulation Used - Transmission of power from generating station to receiving stations - Single Phase House Distribution Systems.

Extra Reading / Keywords: *Transformer Oils, Transformer Testing*

UNIT III: WIRING MATERIALS, COMPONENTS AND TOOLS **12 Hrs**

Wiring Materials: Properties of conducting and insulating materials - Wiring Accessories: Switches and its Types, Main Switches, Sockets, Plugs, Ceiling Rose, Lamp Holders, Choke - Tools: Nose Plier, Poker, Firmer Chistel, Drill, Gimlet, Tester, Megger Tester - Fixing Wiring Accessories on Board - Electrical Components: Electronic Measuring Probes, Voltage or Current Meters and Signal Generators – Testing of Electrical and Electronics Components with Multimeter: Resistor, Capacitor, Transistor & Diode.

Extra Reading / Keywords: *Clutch safety switch, Ignition Switch*

UNIT IV: TYPES OF WIRES, WIRING SYSTEMS AND DRAWINGS 12 Hrs

Types of Residential Wiring Cables and Labeling of Cables - Types of Wiring Systems: Tree system, Distribution system and Ring system – Types of Wiring : Cleat wiring, CTS wiring or TRS wiring or batten wiring, Metal sheathed wiring or lead sheathed wiring, Wooden Casing and capping, Conduit wiring - Factors affecting the choice of wiring system - Types of Drawings: Block Diagram, Circuit Drawing (Diagram),Line Diagram, Wiring Diagram, Wiring Schedule, Parts List and Wiring Preparation.

Extra Reading / Keywords: *Bus bars, Bus duct*

UNIT V: ELECTRICAL PROTECTION AND SAFETY PRECAUTIONS 12 Hrs

Grounding – Bonding –Earthing: Necessity of Earthing, Methods of Earthing: Plate Earthing, Pipe Earthing - Testing of Earthing - Reading of energy meter - Leakage current - Surge current - Load Requirement –Protective Devices: Fuses, Circuit Breakers, Relay, Contactor and Starter - I.E. Rules regarding house wiring - Safety Rules: Electrical maintenance and Precautions

Extra Reading / Keywords: *Electrical surges, Flickering light*

TEXT BOOK

1. Brian Scaddan, Electric Wiring: Domestic,13th Edition, Published by Elsevier Ltd. (2008).

SUGGESTED READINGS

1. R. K. Rajput, A Textbook of Electrical Engineering, Second Revised Edition Laxmi Publication, New Delhi, (2004).
2. Basic Electrical Engineering by M. L. Anwani (2018).

WEB REFERENCES:

1. **https://www.aakash.ac.in/important-concepts/biology/renewable-and-non-renewable-resources**
2. **https://www.britannica.com/technology/transformer-electronics**
3. **https://ncert.nic.in/vocational/pdf/kvcj103.pdf**
4. **https://www.electricaltechnology.org/2015/09/types-of-wiring-systems-electrical-wiring-methods.html**
5. **https://www.elprocus.com/what-is-a-protection-device-different-types-of-protection-devices/**

COURSE OUTCOMES

The Leaner will be able to:

CO No.	CO Description	Cognitive Level
CO-1	recall the basics of sources of energy, transformers, properties of conducting and insulating materials, wires, safety rules.	K1
CO-2	understand the concepts of power generation, transformer & power distribution, Wiring Accessories, tools, wiring systems, protective devices	K2

CO-3	apply the basic principles of energy sources to different applications, transformer , Wiring Accessories& tools, wiring systems, safety devices.	K3
CO-4	analyze energy conservation appliances, house distribution systems, testing of electrical and electronics components, wiring systems and Protective devices	K4
CO-5	Create home renewable energy Systems, house distribution systems, wiring accessories on board, circuit drawing and protective devices for daily life.	K5

PO – COMAPPING

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

PSO – CO MAPPING

	PSO1	**PSO2**	**PSO3**
CO1	**H**	**M**	**L**
CO2	**H**	**M**	**M**
CO3	**H**	**H**	**H**
CO4	**H**	**H**	**H**
CO5	**M**	**H**	**H**

(For Candidates admitted in the Academic year 2022-2023)

Course Title	MAJOR SKILL BASED ELECTIVE 1: PHYSICS FOR LIFE SCIENCES
Code	U22PH3SBP01
Course Type	Theory cum Practical
Semester	III
Hours/Week	2
Credits	1
Marks	100

CONSPECTUS

To understand the various properties of liquids and to gain knowledge about simple equipments.

COURSE OBJECTIVES

1. To understand the basic properties of liquids.
2. To understand the concept of simple equipments such as lens and the working of microscope, centrifuge and decibel meter.
3. To analyze the principle and working of biomedical instruments such as CRO, Ultra Sonogram, ECG.
4. To understand the various properties of liquid, loudness of sound and focal length and power of lens.
5. To analyze the working of sonogram and mammogram and to detect various eye defects.

UNIT I: PROPERTIES OF LIQUIDS **6 Hrs**

Density – Surface tension -Viscosity – Coefficient of Viscosity – Diffusion -Coefficient of diffusion – Diffusion through Membranes - Osmosis and Osmotic Pressure - Body Fluid Distribution.

Extra Reading / Keywords: *Rate of diffusion, desalination*

UNIT II: OPTICS **6 Hrs**

Physical Optics – Spherical lenses (Concave lens and Convex lens) – focal length and power of lens – defects in eye - Optical instruments: Microscope – Telescope.

Extra Reading / Keywords: *Camera, Cataract*

UNIT III: BIOMEDICAL INSTRUMENTS **6 Hrs**

X-rays in medicine - Cathode Ray Oscilloscope (CRO) – Lissajous figures - Ultra sonogram – ECG - Decibel meter - LASER Endoscopy – Pulse Oximeter – Thermometer guns.

Extra Reading / Keywords: *LASIK, ECHO*

UNIT IV: PRACTICALS

1. Surface tension of a liquid by drop weight method
2. Density of a liquid by Hare's apparatus method
3. Decibel meter – Measurement loudness of a sound
4. Diameter of glass tube using Microscope.
5. Focal length and power of convex lens
6. Focal length and power of concave lens
7. Oscilloscope - formation of Lissajous figures

Extra Reading / Keywords: *Viscometer, Neutralization test*

UNIT V: FIELD VISIT

Field visit to scan center and Eye hospital

Extra Reading / Keywords: *Ultra sonogram, Mammogram*

TEXT BOOK

1. R. Murugeshen, Allied physics, 1st edition, S. Chand & Co, New Delhi (2005).

COURSE OUTCOMES

The Learner will be able to :

CO No.	Course Outcomes	Cognitive Level
CO-1	recall the basic properties of liquids, light and list out the biomedical instruments	K1
CO-2	explain the purpose of using lens, microscope centrifuge, decibel meter and biomedical instruments;	K2
CO-3	apply the properties of liquid, sound and light to determine the surface tension of liquid, viscosity of liquid, loudness of sound, focal length of lens and power of lens.	K3
CO-4	Interpret the images and results obtained from the biomedical instruments such as CRO, Ultra Sonogram, ECG to identify the defects.	K4
CO-5	evaluate the working of sonogram and mammogram and to detect various eye defects.	K5

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	H	H	H	H	H
CO-2	H	M	M	H	H	M	H	H	H
CO-3	H	M	M	H	H	H	H	H	H
CO-4	H	H	M	H	H	M	H	H	H
CO-5	H	H	M	H	H	H	H	H	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	M	H	H
CO-2	M	H	H
CO-3	M	H	H
CO-4	M	H	H
CO-5	H	H	H

(For Candidates admitted in the Academic year 2022-2023)

Course Title	Non Major Elective 1:Explore the Universe
Code	U22PH3NMT01
Course Type	Theory
Semester	III
Hours/Week	2
Credits	2
Marks	100

CONSPECTUS:

To understand the formation of the universe, planetary matters and celestial bodies and their features

COURSE OBJECTIVES:

1. To understand the formation of universe, its present and future.
2. To understand the characteristics of planets in the solar system.
3. To understand and analyse the structure and composition of the sun.
4. To understand the various celestial bodies and their features.
5. To understand and explore the space and space travel.

UNIT I: UNIVERSE **6 Hrs**

Introduction- Contents of the Universe- Big Bang- Unification- Early Universe-Present and Future- Galaxies- Milky way galaxy

Extra reading / Key words: *Parallel Universe, Multiverse*

UNIT II: PLANETARY SYSTEM **6 Hrs**

Introduction to Planetary matter - formation of the solar system-planetary matter distribution within the solar system - characteristics of planets in the solar system- features of Earth.

Extra reading / Key words:*Features of Mars, Dwarf Planets*

UNIT III: THE SUN **6 Hrs**

Five regions of the Sun- the structure and composition of the Sun-nuclear fusion in the Sun- solar activity- sunspots- solar flares- solar eclipses.

Extra reading / Key words: *The Moon, Lunar Eclipses*

UNIT IV: CELESTIAL BODIES **6 Hrs**

Introduction to comet, asteroid, meteoroid, meteor, and meteorite- origin of comets and how their tails form - location of asteroids in the solar system - how comets, asteroids, and meteorites influence life on Earth.

Extra reading / Key words: *Kuiper belt, Earth's atmosphere*

UNIT V: SPACE EXPLORATION **6 Hrs**

Space programs in India -International Space Station- Outer Space-Space travel and tourism from Space X and NASA

Extra reading / Key words: *Space suit, Astronauts and Cosmonauts*

TEXTBOOK

1. Exploring the Universe: The Illustrated Guide to Cosmology Book by Brian Clegg.(2012)

SUGGESTED READINGS

1. Brian Clegg, Exploring the Universe: The Illustrated Guide to Cosmology, VIVAYS Publications, 2012.
2. Larry S. Crumpler, Missions To Mars, Harper Design, 2021.
3. Ian Ridpath and Wil Tirion, Stars and Planets: The Most Complete Guide to the Stars, Planets, Galaxies, and Solar System, Princeton University Press, 2017.
4. Tyler Nordgren, Sun Moon Earth, Basic Books, 2016.

WEB REFERNCES:

1. https://viewspace.org/

2. https://www.nasa.gov/content/explore-our-universe

3. https://www.solarsystemscope.com/

4. https://www.universiteitleiden.nl/en/research-dossiers/exploring-the-universe

COURSE OUTCO MES

The Leaner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO-1	Explain the formation of universe and galaxies	K1
CO-2	Compare various types of planets in the solar system and their features	K2
CO-3	explain the structure and composition of Sun	K3

CO-4	analyze the various celestial bodies and their characteristics.	K4
CO-5	Evaluate the values of Space travel and tourism from Space X	K5

CO-PO Mapping

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

CO-PSO Mapping

	PSO1	PSO2	PSO3
CO1	**H**	**H**	**H**
CO2	**M**	**M**	**H**
CO3	**M**	**M**	**H**
CO4	**H**	**H**	**H**
CO5	**M**	**H**	**H**

(For Candidates admitted in the Academic year 2022-2023)

Course Title	MAJOR CORE 8: ELECTRONICS
Code	U22PH4MCT08
Course Type	Theory
Semester	IV
Hours/Week	5
Credits	5
Marks	100

CONSPECTUS

To understand the fundamentals of diodes, Transistors, JFET, MOSFET, SCR, UJT Transistor Amplifiers, Feedback Amplifiers, Oscillators, Operational Amplifiers and their applications.

COURSE OBJECTIVES

1. To understand the functions of diodes and transistors.
2. To understand the working of power devices.
3. To understand the functions of operational amplifier
4. To apply the working principle of transistor as an amplifier and oscillator.
5. To analyze the characteristics of diodes, transistor and power devices

UNIT I: DIODES AND APPLICATIONS 15 Hrs.

Formation of P-N junction V- I characteristics of junction diode- Diode as a rectifier- Half wave rectifier - Full wave rectifier: centre tapped full wave rectifier- Full wave bridge rectifier- Filters: Capacitor filter - Clamping: positive and negative clamping - Clipping: positive and negative clipping- Zener diode- V-I Characteristics of Zener diode- Zener diode as voltage regulator- Working and Application of LED- Tunnel diode

Extra Reading / Keywords: *By pass filters, Construct filter circuit*

UNIT II: TRANSISTOR 15 Hrs.

Transistor action - Characteristics of CE configuration - Transistor as an amplifier in CE arrangement - Transistor load line analysis - operating point -Transistor biasing - stability factor- voltage divider bias- equivalent hybrid circuit of transistor in CE mode - determination of the h parameters from the transistor characteristics - RC coupled amplifier - classification of power amplifiers - Class A, Class BClass C - Push pull amplifiers

Extra Reading / Keywords: *Applications of Transistors*

UNIT III: POWER DEVICES **15 Hrs.**

Construction and working of UJT - Application of UJT as relaxation oscillator - SCR - Half waveSCR - Full wave SCR - JFET - drain and transfer characteristics- comparison between BJT and JFET - MOSFET: Depletion type MOSFET - drain and transfer characteristics-Enhancement typeMOSFET - drain and transfer characteristics.

Extra Reading / Keywords: *DIAC, TRIAC, IGBT*

UNIT IV: FEEDBACK AMPLIFIERS AND OSCILLATOR **15 Hrs.**

Principle of feedback in amplifiers - Positive and negative Feedback - Gain of negative feedback amplifiers - Advantages of negative feedback - Emitter follower - oscillator - Barkhausen criterion - LC oscillators -amplifier as an oscillator - Types of Oscillator - Hartley oscillator, Colpitt's oscillator, Wien - bridge oscillator -Equivalent circuit of a Crystal - Frequency response of a crystal-Transistor crystal oscillator.

Extra Reading / Keywords: *Crystal Oscillator, Dynatron Oscillator, applications of oscillators*

UNIT V: OPERATIONAL AMPLIFIER AND APPLICATIONS **15 Hrs.**

Operational amplifier – differential amplifier – common mode and differential mode signals - CMRR – ideal characteristics of OPAMP – inverting amplifier – non inverting amplifier- Virtual ground – Op amp applications -– summing amplifier – difference amplifier – OPAMP integrator – OPAMP differentiator Wave form generation - Sine and Square wave generator.

Extra Reading / Keywords: *Problem solving, tracing wave forms*

TEXT BOOKS

1. Mehta V.K., Principles of Electronics, S.chand and Company Ltd, New Delhi, 12th Edition (2020).
2. Sedha R.S., A text book of applied Electronics, S.Chand & company Ltd, New Delhi (2019).
3. Bagde. M.K., Singh S.P. and Kaman Singh - Elements of Electronics, S.Chand and company Ltd. (2002).
4. Bhargava N.N, Kulshreshthra D.C.and Gupta S.G., Basic Electronics and Linear circuits- Tata Mc Graw Hill Publishing Co. Ltd, New Delhi 51st reprint (2013).

SUGGESTED READINGS

1. Paranjothi S.R., Electrical circuit analysis, 4th edition, New age publishers; (2011).
2. Chattopadhyay D.C., Rakshit P.C, Saha B. and Purkait N.N., Foundation of electronics, Wiley

Eastern Limited, New Delhi, (2014).

3. Narayana Rao B.V., Principles of Electronics, Vol III, Wiley Eastern and New Age International Limited, New Delhi, 2nd Edition (1992).

WEB REFERENCES

1. https://predictabledesigns.com/an-introduction-to-basic-electronics/
2. https://www.tutorialspoint.com/basic_electronics/basic_electronics_transistors.htm
3. https://www.electronics-tutorials.ws/amplifier/amp_1.html

COURSE OUTCOMES

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO-1	explain the functions of diodes, transistor.	K1
CO-2	discuss the working of power devices, oscillators and operational amplifiers.	K2
CO-3	apply the working principle of transistor to study its function as an amplifier and oscillator.	K3
CO-4	analyze the characteristics of diodes, transistor and power devices.	K4
CO-5	evaluate the parameters of transistor and power devices.	K5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	L	M	M	M	H	H	H	H
CO 2	H	L	M	M	L	H	H	H	H
CO 3	H	H	M	M	L	L	H	H	H
CO 4	H	H	M	M	L	L	H	H	H
CO 5	H	H	M	M	L	H	H	H	L

CO - PSO Mapping

	PSO1	PSO2	PSO3
CO 1	**M**	**H**	**M**
CO 2	**M**	**H**	**M**
CO 3	**M**	**H**	**H**
CO 4	**M**	**H**	**H**
CO 5	**M**	**H**	**H**

(For Candidates admitted in the academic year 2022–2023)

Course Title	MAJOR CORE 9: DIGITAL ELECTRONICS
Code	U22PH4MCT09
Course Type	Theory
Semester	IV
Hours/Week	4
Credits	4
Marks	100

CONSPECTUS:

To understand the fundamental concepts of Digital electronics and the systems used in digital electronics.

COURSE OBJECTIVES:

1. To remember the number systems, code conversions, arithmetic operations and the basics of logic gates.
2. To understand the functions of combinational and sequential circuits.
3. To understand the working of analog/digital converters.
4. To apply the digital principles for the simplification of Boolean expressions.

UNIT I: NUMBER SYSTEMS AND CODES 12 Hrs.

Radix of different Number Systems - conversions: binary to decimal & hexadecimal, decimal to hexadecimal& binary, hexadecimal to binary & decimal - Codes: BCD, Gray, Alphanumeric codes - Binary arithmetic: addition, subtraction, multiplication and division - 1's and 2'scomplement- Laws of Boolean algebra- De- Morgan's theorem -Simplification of Boolean expressions using laws.

Extra reading/Key words: *BCD addition, Excess 3 code*

UNIT II: LOGIC GATES AND SIMPLIFICATION OF BOOLEAN EQUATIONS 12 Hrs.

Logic gates: AND, OR, NOT, NAND, NOR, Ex-OR and their truth tables-NAND and NOR as Universal gate -Boolean expressions for gate networks — Min terms- Karnaugh map forming up tofour variables - Simplification using Karnaugh map- Don't care conditions- **Extra reading/Keywords*:*** *max terms, K maps using max terms*

UNIT III: COMBINATIONALCIRCUITS AND SEQUENCIAL CIRCUITS 12 Hrs.

Half adder–Full adder–Half subtractor– Full subtractor-Multiplexer:4- 1Multiplexer, 8-1 Multiplexer – Demultiplexer:1-16 Demultiplexer – Decoder: BCD to Seven segment decoder- Encoder - Flip Flops: SR Flip Flop, Clocked SR Flip Flop, D Flip Flop.

Extra reading/Key words: *Digital communication*

UNIT IV: REGISTERS AND COUNTERS 12 Hrs.

JK Flip Flop, JK Master slave Flip Flop (Edge Triggering) and T Flip Flop. Registers- Shift registers – Series andParallel Shift registers– Asynchronous counters-mod- n counters- Synchronous counters – Design of Synchronous Counters -Decade counters-

Extra reading/Key words: *timing circuits, programmable devices*

UNIT V: & ANALOG / DIGITAL CONVERTERS 12 Hrs.

Binary weighted resistor D/A converter- R/2R ladder D/A converter -Counter type A/D converter -Dual Slope A/D converter –Successive Approximation A/D Converter- Accuracy and resolution of converters.

Extra reading/Keywords: *Converters using op amps*

TEXT BOOKS

1. V. Vijayendran, Introduction to Integrated Electronics: Digital and Analog, First Edition, S. Viswanathan (Printers & Publishers) Pvt., Ltd (2015).
2. Thomas. L.Floyd, Digital Fundamentals, Eighth Edition, Pearson Education, India (2015).
3. R.P. Jain, Modern Digital Electronics, Fourth Edition, Tata Mc Graw-Hill Education, New Delhi (2010).

SUGGESTED READINGS

1. William H. Gothmann, Digital Electronics- An Introduction to theory & Practice,Second Edition, Prentice Hall of India (2008).
2. Malvino and Leach, Digital Principles and Applications, Fourth Edition, Mc-GrawHill, New York (2010).

WEB REFERENCES

1. http://www.ee.surrey.ac.uk/Projects/CAL/digital-logic/gatesfunc/index.html
2. https://cnx.org/contents/UZM3jSVd@4.19:EH8URZWF@1/Simplification-of-Boolean-Expressions
3. https://www.tutorialspoint.com/computer_logical_organization/combinational_circuits.htm
4. https://www.electronics-tutorials.ws/sequential/seq_1.html
5. https://www.javatpoint.com/counters-in-digital-electronics.

COURSE OUTCOMES:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO 1	recall different number systems and functions of logic gates.	K1
CO 2	understand the functions of combinational and sequential circuits	K2
CO 3	make use of Karnaugh map to simplify the Boolean expressions	K3
CO 4	analyze the significant role of combinational and sequential circuits in real time applications.	K4
CO 5	design synchronous and asynchronous counters of different moduli.	K5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	**H**	**H**	**M**	**H**	**L**	**H**	**H**	**M**	**M**
CO 2	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**L**
CO 3	**H**	**H**	**H**	**M**	**H**	**H**	**H**	**H**	**H**
CO 4	**H**	**H**	**H**	**L**	**H**	**H**	**H**	**H**	**H**
CO 5	**H**	**H**	**M**	**M**	**H**	**H**	**H**	**H**	**H**

CO - PSO Mapping

	PSO1	PSO2	PSO3
CO 1	**M**	**H**	**M**
CO 2	**M**	**H**	**M**
CO 3	**M**	**H**	**H**
CO 4	**M**	**H**	**H**
CO 5	**M**	**H**	**H**

(For Candidates admitted in the academic year 2022-2023)

Course Title	**Major Elective 2 : SENSORS**
Code	**U22PH4MET02**
Course Type	**Theory**
Semester	**IV**
Hours/Week	**4**
Credits	**3**
Marks	**100**

CONSPECTUS

To understand the fundamental concepts of sensors and its applications in various fields.

COURSE OBJECTIVES

1. To remember the basic usage of sensors in everyday life.
2. To understand the properties of diverse range of sensors and their working.
3. To understand the classification of sensors and their usage.
4. To apply the concepts of sensors in various fields like industry and medicine.
5. To analyze the static and dynamic characteristics of sensors.

UNIT I: INTRODUCTION TO SENSORS 12Hrs.

Principle – Classification of sensors – Characteristics: Static and Dynamic characteristics – Characterization: Electrical, Mechanical, Optical and Thermal –Materials used for sensors.

Extra Reading / Keywords: *active sensor, passive sensor*

UNIT II: THERMAL SENSORS 12Hrs.

Thermoelectric Sensors – Pyroelectric Sensors – Piezoelectric Sensors – Piezo resistive Sensors – Capacitiveand Inductive Sensors.

Extra Reading / Keywords: *semiconductor sensor, thermistors*

UNIT III: OPTICAL SENSORS 12Hrs.

Photovoltaic Sensors – Photoelectric Sensors – Fiber Optic Sensors – Laser Sensors – Infrared Sensors – LUX meter.

Extra Reading / Keywords: *IR sensor, chemi- luminescence sensor*

UNIT IV: SMART SENSORS **12Hrs.**

Proximity Sensors – Motion / Occupancy Sensors – Nano Sensors – Bluetooth Smart Sensor – LIDAR SmartSensors – pH sensor – Dimension sensor – Gas sensor.

Extra Reading / Keywords: *flow sensor, contact sensor*

UNIT V: APPLICATIONS OF SENSORS **12Hrs.**

Home Appliance Sensors – Aerospace Sensors – Medical Diagnostic Sensors – Tactile Sensors – Photovoltaic-Powered Sensors – Gyroscope Sensors.

Extra Reading / Keywords: *self-driving cars, mobile phones.*

TEXT BOOKS

1. Sawhney. A.K, "A Course in Electrical and Electronics Measurements and Instrumentation", 18th Edition, DhanpatRai& Company Private Limited, 2007.
2. Patranabis. D, "Sensors and Transducers", Prentice Hall of India, 2003.

SUGGESTED READINGS

1. Jacob Fraden, Hand Book of Modern Sensors, 5th Edition, Springer (2016)
2. Jose Luis Santos, Faramarz Farahi, Hand Book of Optical Sensors, 1st Edition, CRC Press (2014).

WEB REFERENCES

1. https://web.iit.edu/sites/web/files/departments/academic-affairs/academic-resource-center/pdfs/SENSORS.pdf
2. https://www.philadelphia.edu.jo/academics/kaubaidy/uploads/Sensor-Lect2.pdf
3. https://research.iaun.ac.ir/pd/abbas.chatraei/pdfs/UploadFile_1903.pdf
4. https://www.researchgate.net/publication/326926012_Sensors_and_Applications_in_Measuring_and_A utomatio n_Control_Systems_Book_Series_Advances_in_Sensors_Reviews_Vol_4

COURSE OUTCOMES:

The Learner will be able to:

COs	CO Description	Cognitive Level
CO1	recall the basic concepts of sensors and their applications in everyday life.	K1
CO2	understand the classification of sensors and their static and dynamic characteristics.	K2
CO3	apply the working of Pyro electric Sensors, Nano Sensors, Photoelectric Sensors to various real time problems.	K3
CO4	analyze the use of sensors in the fields of medicine, commercial industry and research.	K4
CO5	criticize the role of thermal, optical and smart sensors in the industrial, medicine and research sectors.	K5

PO – CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	M	H	M	L	L	M	L	L
CO2	H	H	M	M	L	M	M	M	L
CO3	H	H	M	M	M	L	L	H	M
CO4	H	H	M	M	L	M	L	H	H
CO5	H	H	M	M	L	M	M	H	H

PSO – CO MAPPING

	PSO1	PSO2	PSO3
CO1	H	M	L
CO2	H	H	H
CO3	M	H	M
CO4	H	H	H
CO5	H	H	H

(For Candidates admitted in the Academic year 2022-2023)

Course Title	ALLIED 5: ALLIED PHYSICS PRACTICALS
Code	U22PH4ALP08
Course Type	Practical
Semester	IV
Hours/Week	4
Credits	2
Marks	100

CONSPECTUS:

To understand the basics of Properties of matter, Optics, Electricity and Electronics by doing related experiments.

COURSE OBJECTIVES

1. To determine the elastic moduli of given materials.
2. To study the surface tension and viscosity of different liquids.
3. To understand the functions of logic gates by constructing them using discrete components.
4. To apply the digital principles to study the universal gates, Half Adder and Half subtractor.
5. To analyze V-I characteristics of junction diode, Zener diode and transistor.

LIST OF EXPERIMENTS

1. Determination of Young's modulus of the material of a bar by non-uniform bending using (Pin and Microscope).
2. Determination of Rigidity modulus of the material of a rod- Static Torsion.
3. Comparison of viscosities of two liquids using burette method.
4. Determination of Surface Tension by Drop Weight method.
5. Determination of Radius of Curvature of a lens-Newton's Rings.
6. Determination of refractive index of the material of prism using Spectrometer.
7. Determination of thickness of a wire – Air wedge.
8. Study of Junction Diode characteristics.

9. Study of Zener Diode characteristics.

10. Construction and study of Bridge Rectifier.

11. Construction and study of Regulated Power Supply using Zener Diode

12. Study of transistor characteristics– Common Emitter configuration.

13. Study of AND, OR Logic gates using discrete components.

14. Study of NAND and NOR as Universal logic gates.

15. Verification of Demorgan's Theorems using IC chips.

16. Study of half adder and half subtractor using IC chips.

WEB REFERENCES:

2. http://vlabs.iitkgp.ernet.in/be/exp10/zenercharac.html
3. http://vlabs.iitkgp.ernet.in/be/exp10/znrli_ver1.html
4. http://vlabs.iitkgp.ernet.in/be/exp11/index.html
5. http://mpv-au.vlabs.ac.in/modern-physics/Abbes_Refracrometer/experiment.html
6. chttp://ov-au.vlabs.ac.in/optics/Spectrometer_Refractive_Index/experiment.html
7. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/engg_physics/labs/exp1/simulation/simulator.html
8. http://vlabs.iitkgp.ac.in/be/exp5/index.html

COURSEOUTCOMES:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO-1	recall the fundamental properties of matter.	K1
CO-2	understand the surface tension and viscosity of different liquids.	K2
CO-3	demonstrate experiments to study the various phenomena of light.	K3
CO-4	analyze the universality of NAND and NOR gates	K4
CO-5	plot V-I characteristics to evaluate the parameters of diodes and transistors	K5

(For Candidates admitted in the Academic year 2022-2023)

Course Title	ALLIED 6: MODERN PHYSICS, ELECTRICITY AND ELECTRONICS
Code	U22PH4ALT09
Course Type	Theory
Semester	IV
Hours/Week	4
Credits	2
Marks	100

CONSPECTUS

To understand the vector model of an atom, the liquid drop model for nucleus, basic concepts of electricity, electromagnetism and semiconductor devices.

COURSE OBJECTIVES

1. To remember the principles of electricity and electromagnetism.
2. To understand the photoelectric effect and it applications.
3. To understand the process of nuclear fission and fusion.
4. To understand the working of semiconductor devices.

UNIT I: ATOMIC PHYSICS 12Hrs.

Photo electric effect - Laws of photoelectric effect - Einstein's photoelectric equation - Experimental verification - Millikan's experiment- applications of Photo electric effect- Photo electric cells - Applications of photoelectric cells-Compton effect - experimental verification- Vector Atom Model - Pauli's Exclusion Principle- Aufbau principle, Hunds rule- electronic configuration of some elements.

Extra reading / Key words: *Photoelectrons, Bragg's law*

UNIT II: NUCLEAR PHYSICS 12Hrs.

Nucleus size, charge, mass, spin - nuclear forces - nuclear fission and fusion (Quantitative study only) - Nuclear Models - Liquid drop model-shell model - Radioactivity - properties of radioactive radiations - law of radioactive disintegration - Mean life – Half-life period - law of Successive disintegration - Applications of radio isotopes: radio carbon dating.

Extra reading / Key words: *Dispersion, Hertz effect*

UNIT III: ELECTRICITY 12Hrs.

Electrostatics - Coulomb's inverse square law - electric field - electric field intensity - electric potential- electricflux - Gauss theorem and its applications (Intensity at a point due to a charged sphere & cylinder) - Principle of acapacitor- capacitance of a spherical capacitor with outer and inner sphere earthed - capacitance of a cylindricalcapacitor - energy stored in a charged capacitor - Loss of energy on sharing of charges between two capacitors

Extra reading / Key words: *Charge, Discharge, Surface charge density*

UNIT IV: ELECTROMAGNETISM 12Hrs.

Force on a current carrying conductor - Flemings left hand rule -Laws of electromagnetic induction – Self- induction - Self-inductance of a long solenoid - determination of coefficient of Self-inductance by Anderson's method - Mutual induction - coefficient of coupling- determination of coefficient of mutual inductance by Rayleigh's method- growth and decay of current in circuit containing L&R.

Extra reading / Key words: *Potential difference, Torque, Magnetic field*

UNIT V: SEMICONDUCTOR DEVICES 12 Hrs.

Semiconductors - doping - intrinsic and extrinsic semiconductor -PN junction diode – formation PN junction - volt-ampere characteristics of PN junction - junction diode as a rectifier - bridge rectifier - Zener diode - breakdown mechanism - Zener as a voltage regulator- Principle and working of a PNP transistor – Characteristics of a transistorin CE configuration - transistor as an amplifier - construction of AND, OR and NOT logical gates using diodes andtransistors.

Extra reading / Key words: *Breakdown, Operational amplifier, Logic operations*

TEXT BOOKS

1. Murugeshan. R, Allied Physics, S. Chand & Co. Ltd, New Delhi (2005).
2. Murugeshan, R, Modern Physics, S. Chand & Company Ltd, New Delhi (2006).
3. Satya Prakash, Electricity and Magnetism, Pragati Prakashan, XXXI edition (2016).
4. Vijayendran. V, Introduction to Integrated Electronics, S.Viswanathan publishers, Chennai (2009).

SUGGESTED READINGS

1. Edward M. Purcell, David J.Morin, Electricity and Magnetism, Cambridge University Press, 3rd edition(2013)

2. Kulkarni.S.Y, Somanathan Nair.B ,Shree Krishna Kumar.K, Basic Electronics, I K International PublishingHouse, Bengaluru(2011).
3. Jain, R.P., Modern Digital Electronics, Tata McGraw Hill India Ltd., New Delhi, Fourth Edition (2010).
4. Gupta. A.B,Modern Atomic and Nuclear Physics, Books & Allied Ltd; 2nd edition(2009).
5. Brian R Martin, Nuclear and Particle Physics: An Introduction, Wiley–Blackwell (2006).

WEB REFERENCES

1. https://byjus.com/jee/photoelectric-effect/
2. https://www.britannica.com/science/radioactive-isotope
3. https://www.brainkart.com/article/Gauss-s-law-and-its-applications_528/
4. https://www.vedantu.com/neet/difference-between-self-inductance-and-mutual-inductance
5. https://www.electronicshub.org/types-of-semiconductor-devices/

COURSE OUTCOMES

The Leaner will be able to:

COs	CO Description	Cognitive Level
CO1	recall the fundamentals of electricity and electromagnetism.	K1
CO2	understand the process of nuclear fission and fusion and working of semiconductor devices.	K2
CO3	apply the theoretical knowledge on fundamental of physics to solve the real-time problems.	K3
CO4	analyze the growth and decay of current in LR circuits.	K4
CO5	evaluate the parameters of diodes and transistors by analyzing the V-I characteristics.	K5

PO-CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	H	M	M	M	H	H	M	L
CO 2	H	H	L	M	M	H	H	L	H
CO 3	H	H	H	L	M	H	H	H	H
CO 4	H	H	M	M	M	H	H	H	H
CO 5	H	H	H	M	M	H	H	H	H

PSO - CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	M	H
CO 2	H	M	M
CO 3	H	H	H
CO 4	H	H	H
CO 5	H	H	H

(For Candidates admitted in the Academic year 2022-2023)

Course Title	Allied Physics 2: Digital and Microprocessor Practicals (for Computer Science)
Code	U22PH4ALP11
Course Type	Practical
Semester	IV
Hours/Week	4
Credits	2
Marks	100

CONSPECTUS

To understand the basic role of logic gates in digital circuits, to study the basic digital circuits and to do simple programs in microprocessor.

COURSE OBJECTIVES

1. To understand the working of basic digital circuits using digital kits.
2. To understand the working of counters and registers using digital kits.
3. To construct the combinational circuits.
4. To analyze the various microprocessor programs.

LIST OF EXPERIMENTS

1. Study of IC Chips.
2. Verification of De – Morgan's Theorems.
3. Study of NAND as a universal gate.
4. Study of NOR as a universal gate
5. Karnaugh Map - Construction of circuit using simplified Boolean expression.
6. Study of R-S, J-K and D Flip Flops.
7. Study of Encoders and Decoders.
8. Study of Half adder, Half Subtractor and Full adder circuits.
9. Study of Shift Left and Right registers.
10. Study of Multiplexer and Demultiplexer using ICs.
11. Microprocessor – Programming for addition and subtraction.
12. Microprocessor – Programming for identifying the largest and smallest number from a series.
13. Microprocessor – Programming for arranging the numbers in Ascending and descending orders.
14. Microprocessor – Sum of series of 8 bit numbers whose sum is 8 bit and 16bit.

15. Microprocessor – Programming for block transfer.
16. Microprocessor – Programming for Rolling Display.

WEB REFERENCES

1. http://vlabs.iitb.ac.in/vlabs-dev/labs_local/digital_application/labs/exp14/simulation.php
2. Mobile app – 8085 simulator
3. http://vlabs.iitb.ac.in/vlabs-dev/labs/digital-electronics/experiments/verification-decoder-demultiplexer- encoder-iitr/simulation.html

**COURSE OUTCOMES **

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO-1	recall the working of basic digital circuits through experiments.	**K1**
CO-2	understand the working of counters and registers using digital kits.	**K2**
CO-3	construct combinational circuits and verify the truth tables.	**K3**
CO-4	execute various assembly language programs using microprocessor kit.	**K4**

(For Candidates admitted in the Academic year 2022-2023)

Course Title	Allied Physics 3: Fundamentals of Microprocessor INTEL 8085 (for Computer Science)
Code	U22PH4ALT10
Course Type	Theory
Semester	IV
Hours/Week	4
Credits	2
Marks	100

CONSPECTUS

To acquire basic knowledge of INTEL 8085, to write simple programs using the instruction set and to know some applications by interfacing.

COURSE OBJECTIVES

1. To remember the purpose of different memory devices.
2. To understand the architecture and instruction set of INTEL 8085.
3. To apply the instructions of INTEL 8085 to write simple programs.
4. To understand the interfacing techniques involved in INTEL8085.
5. To analyze the real time applications of INTEL 8085.

UNIT I: MEMORIES 12 Hrs.

Introduction to Memories-Read only Memories (ROM): Bipolar ROMs-Metal Oxide Semiconductor (MOS) ROMs - Application of ROM - Static Random Access Memories: Bipolar RAMs-MOSRAMs – Dynamic Random Access Memories.

Extra Reading/Keywords: *Magnetic tape, Hard disk drive*

UNIT II: ARCHITECTURE AND INSTRUCTION SET OF INTEL 8085 12 Hrs.

General Architecture of microcomputer -Architecture of INTEL 8085–Pin configuration– Instruction word size -Instruction and data formats – Addressing modes - Instructions set- Opcodes –Data transfer group-Arithmetic group-Logical group-Branch group–Stack, I/O and machine control group.

Extra Reading/Keywords: *Instruction decoder, Machine cycle encoder, Control instructions, Limitations*

UNIT III: PROGRAMMING OF MICROPROCESSOR 12 Hrs.

Assembly language – Subroutine- Addition of two 8 bit numbers (with and without carry) Subtraction of two 8 bit numbers - Finding smallest / largest element of an integer array- Arranging an integer array in ascending and descending order–Sum of a series of 8 bit numbers-8 bit multiplication-8 bit division.

Extra Reading / Keywords: *subtraction of 16-bit numbers, alter the contents of flag register*

UNIT IV: INTERFACING TECHNIQUES 12 Hrs.

Address space partitioning-Data transfers Scheme-synchronous data transfer - Asynchronous data transfer - Interrupt driven data transfer- Interrupts of Intel 8085 - Programmable peripheral interface-Architecture of Intel 8255-Architecture - Operating modes - Control word - Programmable DMAcontrollerIntel8257-Interruptcontroller8259

Extra Reading/Keywords: *Serial/parallel interfacing device, memory interfacing*

UNIT V: MICROPROCESSOR APPLICATIONS 12 Hrs.

Interfacing of ADC 0808/ADC0809 - Delay subroutine – Delay subroutine using one register -7 segment LED display – display of decimal numbers 0 to 9 - display of alphanumeric characters – formation of codes for alpha numeric characters – microprocessor-based Traffic Control – to generate square wave using I/O port-to generate square wave using SOD line.

Extra Reading/Key words: *Embedded systems, Stepper motor*

TEXTBOOKS

1. William H. Gothmann, Digital Electronics-An Introduction to Theory and Practice, Second Edition, Prentice Hall of India Pvt. Ltd, New Delhi (2013).
2. Ram B, Fundamentals of microprocessors and microcomputer ,8th Edition, Dhanapat Rai Publications (P)Ltd, New Delhi (2013).

SUGGESTED READINGS

1. Ramesh Ganokar, Microprocessor: Architecture, Programming and Applications with ,6th Edition, PenramInternational Publishing (India)Pvt. *Ltd*. Mumbai(2013).
2. Nagoor KaniA., Microprocessors and Microcontrollers, 1st Edition, RBA Publications, Chennai(2017).

WEB REFERENCES

2. https://www.vssut.ac.in/lecture_notes/lecture1423813120.pdf
3. https://www.tutorialspoint.com/microprocessor/microprocessor_tutorial.pdf
4. https://archive.nptel.ac.in/content/storage2/courses/106108100/pdf/Lecture_Notes/LNm1.pdf

COURSE OUTCOMES

The Learner will be able to:

CO No.	CO Description	Cognitive Level
CO-1	recall the fundamental of memory devices.	K1
CO-2	explain the architecture and instruction set of INTEL 8085.	K2
CO-3	apply the instructions of INTEL 8085 to write simple programs.	K3
CO-4	analyze the real time applications of INTEL 8085	K4
CO-5	evaluate the role of memory devices and registers used in microprocessor INTEL 8085.	K5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	H	H	M	M	L	H	L	L
CO2	H	H	H	M	L	L	H	H	H
CO3	H	H	H	M	H	H	H	H	H
CO4	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H

CO-PSO Mapping

	PSO1	PSO2	PSO3
CO1	M	H	M
CO2	M	H	H
CO3	H	H	H
CO4	H	H	H
CO5	H	H	H

(For Candidates admitted in the Academic year 2022-2023)

Course Title	Non Major Elective - 2: PLAY WITH LIGHT AND FLUIDS
Code	U22PH4NMP02
Course Type	Practical
Semester	IV
Hours/Week	2
Credits	2
Marks	100

CONSPECTUS:

To understand the basic properties of linear optics, fluids by determining the parameters with experiments.

COURSE OBJECTIVES

1. To recall the basics of light and fluid dynamics.
2. To understand the linear properties of light.
3. To understand the behaviour of fluids.

LIST OF EXPERIMENTS

1. Study the reflection property of light using plane mirror and pins.
2. Study the refraction property of light through glass slab.
3. Study the diffraction property of light using laser.
4. Determine the focal length of convex lens.
5. Determine the critical angle for total internal reflection.
6. Study the divergence and coherence property of normal light and laser beam.
7. Determine the density of liquid using Hare's apparatus
8. Determine the surface tension of liquid using drop weight method
9. Determine the viscosity of low viscous liquid.
10. Determine the viscosity of high viscous liquid.

WEB REFERENCES:

1. https://www.olabs.edu.in/?sub=74&brch=9&sim=37&cnt=58
2. http://aven.amritalearning.com/index.php?sub=101&brch=299&sim=1511&cnt=3501
3. https://www.olabs.edu.in/?sub=1&brch=6&sim=244&cnt=4
4. https://docs.quantumatk.com/tutorials/viscosity_methanol/viscosity_methanol.html

COURSE OUTCOMES:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO-1	recall the basics of light and fluid dynamics.	K1
CO-2	understand the linear properties of light	K2
CO-3	apply the fundamental principles to study the behaviour of fluids	K3