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 endeavors 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 2021-2022)

HOLY CROSS COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI – 620 002
SCHOOL OF PHYSICAL SCIENCES
PG AND RESEARCH DEPARTMENT OF PHYSICS
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOME-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	Tamil Paper I/ Hindi Paper I/ French Paper I	U21TL1GEN01/ U21HN1HIN01/ U21FR1FRE01	3	3	100
	II	English – 1	English Paper -I	U21EL1GEN01	3	3	100
	III	Major Core - 1	Properties of Matter and Mechanics	U21PH1MCT01	5	4	100
		Major Core - 2	Optics	U21PH1MCT02	5	4	100
		Major Core - 3	Main Practical I: General Physics Practicals	-	3	-	-
		Allied – 1	Mathematics I - Algebra, Calculus, Trigonometry	U21MA1ALT01	4	2	100
		Allied – 2	Mathematics II- Analytical Geometry of Three Dimensions and Vector Calculus	U21MA1ALT06	4	2	100
	IV	Environental Studies	Environmental Studies	U21RE1EST01	2	1	100
		Value Education	Ethics/Bible studies/Catechism	U21VE2LVE01/ U21VE2LVB01/ U21VE2LVC01	1	--	--
			Service Oriented Course		--	--	--
			Internship/ Field Work/ Field Project 30 Hours - Extra Credit	U21SP1ECC01		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	Tamil Paper II/ Hindi Paper II/ French Paper II	U21TL2GEN02/ U21HN2HIN02 U21FR2FRE02	3	3	100
	II	English – 2	English paper -II	U21EL2GEN02	3	3	100
	III	Major Core – 3	Main Practical I: General Physics Practicals	U21PH2MCP03	3	4	100
		Major Core – 4	Heat, Thermodynamics and Statistical Mechanics	U21PH2MCT04	6	5	100
		Allied – 3	Mathematics III - Laplace Transform, Partial Differential Equations and Fourier Series	U21MA2ALT08	4	2	100
		Major Elective -1	Outside/ Inside School		5	3	100
	IV	Skill Based Course (SBC)- 1	Soft skill development	U21SS2SBC01	2	1	100
		Skill Based Course (SBC)- 2	Sustainable Rural Development and Student Social Responsibility	U21RE2SBC02	2	1	100
		Industrial Relations	Photovoltaic Systems	U21PH2IRT01	1	1	100
		Value Education	Ethics/Bible studies/Catechism	U21VE2LVE01/ U21VE2LVB01/ U21VE2LVC01	1	1	100
			Service Oriented Course		--	--	
			Internship / Field Work /Field Project 30 Hours -Extra Credit	U21SP2ECC02	--	2 Extra Credits	100
	TOTAL				**30**	**24+2**	**1000+ 100**

Sem	Part	Course	Title of the Course	Code	Hrs/ Wk	Credits	Marks
III	I	Language – 3	Tamil Paper III/ Hindi Paper III/ French Paper III	U21TL3GEN03/ U21HN3HIN03 U21FR3FRE03	3	3	100
	II	English – 3	English paper –III	U21EL3GEN03	3	3	100
	III	Major Core – 5	Electricity and Electromagnetism	U21PH3MCT05	6	5	100
	III	Major Core – 6	Main Practical II- Optics, Electricity and Electronics Practicals	-	3	-	-
	III	Allied Paper – 4	Allied : Chemistry Paper - I / Allied : Database Management Systems	U21CH3ALT05/ U21CA3ALT05	4	2	100
	III	Major Elective – 2			4	3	100
	IV	Major Skill Based Elective	Basic Skills in Biological Science / Biological Techniques for Physics	U21ZO3SBP02/ U21BO3SBP04	2	1	100
	IV	Non Major Elective – 1			3	3	100
	IV	Gender Studies	Gender Studies	U21WS3GST01	1	1	100
	IV	Value Education	Ethics/Bible Studies/Catechism		1	--	--
			Service Oriented Course		--	--	--
			Internship/Field work/Field Project – 30 Hours – Extra Credit	U21SP3ECC03	--	2 (Extra Credits)	100
	TOTAL				**30**	**21+2**	**800+ 100**

Sem	Part	Course	Title of the Course	Code	Hrs/ Wk	Credits	Marks
IV	I	Language – 4	Tamil Paper IV/ Hindi Paper IV/ French Paper IV	U21TL4GEN04/ U21HN4HIN04 U21FR4FRE04	3	3	100
	II	English – 4	English Paper –IV	U21EL4GEN04	3	3	100
	III	Major Core – 6	Main Practical II- Optics, Electricity and Electronics Practicals	U21PH4MCP06	3	4	100
	III	Major Core – 7	Electronics	U21PH4MCT07	5	5	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 – 3			4	3	100
	III	Non Major Elective – 2			3	3	100
	IV	Value Education	Ethics/Bible Studies/ Catechism		1	1	100
			Service Oriented Course		--	2(Extra Credit)	100
			Internship/Field work/Field Project – 30 Hours – Extra Credit	U21SP4ECC04	--	2 (Extra Credits)	100
	TOTAL				**30**	**26+4**	**900+ 200**

Sem	Part	Course	Title of the Course	Code	Hrs/ Wk	Credits	Marks
V	III	Major Core - 8	Classical and Quantum Mechanics	U21PH5MCT08	5	5	100
	III	Major Core - 9	Atomic and Molecular Physics	U21PH5MCT09	5	4	100
	III	Major Core - 10	Main Practical III: Advanced Electronics & Digital Practicals	U21PH5MCP10	6	4	100
	III	Major Core - 11	Digital Electronics	U21PH5MCT11	4	4	100
	III	Major Elective –4			4	3	100
	IV	Non Major Elective– 3			3	3	100
	IV	Major Skill Based Course –II	Problem solving skills in Physics	U21PH5SBT02	2	1	100
	IV	Extra Credit	Online Course	U21OC5ECT01	-	2 (Extra Credit)	100
	IV	Value Education	Ethics/Bible studies/Catechism		1	--	--
	IV		Internship/Field work/Field Project – 30 Hours – Extra Credit	U21SP5ECC05	-	2 (Extra Credit)	100
		Total			**30**	**24+4**	**700 +200**

Sem	Part	Course	Title of the Course	Code	Hrs/ Wk	Credits	Marks
VI	III	Major Core - 12	Mathematical Physics	U21PH6MCT12	5	5	100
	III	Major Core -13	Solid State Physics	U21PH6MCT13	4	4	100
	III	Major Core - 14	Spectroscopy	U21PH6MCT14	4	4	100
	III	Major Core - 15	Nuclear and Particle Physics	U21PH6MCT15	5	5	100
	III	Major Core - 16	Main Practical IV : Advanced Digital and Microprocessor Practicals	U21PH6MCP16	6	4	100
	IV	Non Major Elective – 4			3	3	100
	IV	Skill Based Course (SBC)	Research Methodology	U21DS6SBC03	2	1	100
	IV	Value Education	Value Education Ethics/Bible studies/Catechism		1	--	100
	IV		Internship/Field work/Field Project – 30 Hours – Extra Credit	U21SP6ECC06	-	2 (Extra Credit)	100
	IV		RESCAPES			4 (Extra Credit)	100
	TOTAL				**30**	**26+6**	**800 + 200**
	GRAND TOTAL				**180**	**140+ 20**	**5400**

Allied papers offered by department of Physics

Sem	Part		Course	Title of the Course	Code
I	III	For Maths	ALLIED 1	Properties of Matter, Optics and Sound	U21PH1ALT01
		For Maths	ALLIED 2	Allied Physics Practicals	U21PH1ALP02
		For CS	ALLIED 2	Digital Electronics	U21PH1ALT03
II	III	For Maths	ALLIED 3	Modern Physics, Electricity and Electronics	U21PH2ALT04
III	III	For Chemistry	ALLIED 4	Basic Physics I	U21PH3ALT05
		For B. Voc. (SD)	ALLIED 4	Digital Electronics andMicroprocessor	U22PH3ALT06
IV	III	For Chemistry	ALLIED 5	Basic Physics Practicals	U21PH4ALP07
		For Chemistry	ALLIED 6	Basic Physics II	U21PH4ALT08
		For Biotechnology	ALLIED 5	Biophysics	U21PH4ALT09
		For Biotechnology	ALLIED 6	Biophysics Practicals	U21PH4ALP10
		For C.S.	ALLIED 5	Fundamentals of microprocessor INTEL 8085	U21PH4ALT11
		For C.S.	ALLIED 6	Digital and Microprocessor practicals	U21PH4ALP12

Major elective papers offered by the Department of Physics:

Sem	Part	Course	Title of the Course	Code	Hrs/ Wk	Credits	Marks
II	III	Major Elective -1	Digital Principles / Renewable Energy	U21PH2MET01/ U21PH2MET02	4	3	100
III	III	Major Elective – 2	Geophysics / Domestic Power Generation and House Wiring	U21PH3MET03/ U21PH3MET04	4	3	100
IV	III	Major Elective – 3	Circuit and Network Analysis/ Sensors	U21PH4MET05/ U21PH4MET06	4	3	100
V	III	Major Elective – 4	Communication Physics / Microprocessor INTEL 8085	U21PH5MET07/ U21PH5MET08	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	Fundamentals of Digital Systems and Computer Electronics	U21PH3NMT01	3	3	100
IV	IV	Non Major Elective – 2	Explore the Universe	U21PH4NMT02	3	3	100
V	IV	Non Major Elective – 3	Physics of Photography	U21PH5NMT03	3	3	100
VI	IV	Non Major Elective – 4	Physics for competitive Exams	U21PH6NMT04	3	3	100

(For Candidates admitted in the Academic year 2021-2022)

Course Title	MAJOR CORE 1: PROPERTIES OF MATTER AND MECHANICS
Code	U21PH1MCT01
Course Type	Theory
Semester	I
Hours/Week	5
Credits	4
Marks	100

CONSPECTUS: To study the basic principle and concepts of gravitation, properties of matter, rigid body dynamics.

COURSE OBJECTIVES:

1. To understand the basic ideas of Gravitation on the basis of Kepler law and properties of matter.
2. To understand the mechanics of rigid bodies and apply it to solve problems in rigid body dynamics.
3. To understand the concept of surface tension and viscosity with different measuring Experiments
4. To understand simple harmonic oscillator and apply it to solve problems in mechanics and understand the basics of wave motion.
5. To Study the concepts of general and special theory of relativity and understand the idea of space, mass and time on the basis of Einstein's concepts

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 constants and Poisson's ratio–Bending of beams–Bending couple–Cantilever depression and oscillation–Measurement of Young's modulus by non–uniform bending, uniform bending and cantilever depression.

Torsion – couple per unit twist for solid and hollow cylinders – Work done in twisting a wire – Torsion pendulum – static torsion method.

Extra reading / Key words: *Gravitational constant, Gravitational field and gravitational potential*

UNIT II: DYNAMICS OF RIGID BODIES (15 Hrs)

Moment of inertia - Radius of gyration - Theorems of M .I - M.I of circular disc, solid cylinder, hollow cylinder - K.E of a rotating body – M.I of a diatomic molecule – Rotational energy state of a rigid diatomic molecule – centre of mass-conservation laws- conservation forces and energy-negative gradient of potential energy- laws of conservation of momentum –angular momentum-conservation of angular momentum.

Extra reading / Key words: *Compound pendulum, Simple pendulum*

UNIT III: SURFACE TENSIONAND VISCOSITY (15 Hrs)

Surface tension–Angle of contact–Pressure difference across a liquid surface—Experimental determination of surface tension–Jaeger's method–Quincke's method–Drop weight method– Capillary rise method.

Viscosity- coefficient of viscosity—streamline flow of 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-Bernoulli theorem- venturimeter - filter pump- the atomizer.

Extra reading / Key words: *Flow of liquid, Neumann's triangle, Rankine's method*

UNIT IV: WAVES AND OSCILLATIONS ((15 Hrs))

Simple harmonic motion - Periodic and simple harmonic motions – Average values of kinetic and potential energies of a harmonic oscillator - Superposition of two or more Simple Harmonic Oscillators - Differential Equation for Simple Harmonic Oscillator and its General Solution – Damped and Forced Oscillators – Resonance – Wave motion – characteristics of wave motion- Transverse wave motion- Longitudinal wave motion-Equation of simple harmonic wave- Differential equation of wave motion-particle velocity- wave velocity.

Extra reading / Key words: *Coherent state, Displacement operator*

UNIT V: SPECIAL THEORY OF RELATIVITY ((15 Hrs))

Galilean – Newtonian relativity, Galilean transformations – Michelson Morley experiment and its importance – Einstein's postulates – Lorentz transformations and its 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 / Key words: *Einstein, Speed of light*

TEXT BOOKS

1. Mathur D.S, P S Hemne, Mechanics, S. Chand & Co., (2014).
2. Brijlal and N. Subramaniam, Properties of Matter. S. Chand & Co, New Delhi (1994).
3. R. Murugeshan, Properties of Matter, S. Chand & Company Ltd, New Delhi (2016).
4. N.Subrahmanyam Brij Lal, Waves and Oscillations, Vikas Publishing House PVP Ltd., New Delhi (2006).

SUGGESTED READINGS

1. R.N. Chaudrey, Waves and Oscillations, New Age International Publishers (2010).
2. D. Halliday, R. Resnick and J. Walker, Fundamentals of Physics, Wiley, NY, 6th edition (2000).

COURSE OUTCOMES:

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 and fluid properties.	K1
CO 2	Understand the relation between different moduli of elasticity, explain surface tension, differentiate stream line and turbulent flow of motion, diffusivity, osmotic pressure, explain the dynamics of rigid bodies and conservation laws &derive Lorentz transformation equations and state the postulates of Einstein's special theory of relativity	K2
CO 3	Apply physics principles learnt such as bending of beams, torsion, angle of contact, Bernoulli's theorem, diffusion, osmosis and conservation laws 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 2021-2022)

Course Title	MAJOR CORE 2: OPTICS
Code	U21PH1MCT02
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 ((12 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's eyepieces.

Extra reading / Key words: *simple experiment using lens, Laser tuning, Optical coherence tomography systems*

UNIT II:INTERFERENCE ((12 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 neighbouring lines.

Extra reading / Key words: *Flatness testing, Fabry- Perot Interferometer*

UNIT III:DIFFRACTION AND POLARISATION ((12 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:LASERS ((12 Hrs))

Absorption and Emission - Spontaneous emission - Stimulated emission – Einstein coefficients -Basic principles of lasers-population inversion-pumpingTypes of laser-Solid state lasers-Ruby- Nd YAG laser- Gas lasers- He-Ne lasers- Semiconductors lasers- Diode laser- p-n junction laser.

Extra reading / Key words: *Photons, Excitation*

UNIT V:INTRODUCTION TO NON LINEAR OPTICS ((12 Hrs))

Linear and nonlinear – Nonlinear 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- bistability- Self focusing.

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

Note: Texts given in the Extra reading / Key words must be tested only through assignment and seminars.

TEXT BOOKS

1. Murugeshan,R and Kiruthiga Sivaprasath, Optics and Spectroscopy, S.Chand and Company, Ltd. (2010).
2. B.B Laud, Lasers and Nonlinear Optics, New Age international (P) Ltd. New Delhi, 2nd Edition (1991).

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 2021-2022)

Course Title	Allied Physics Paper 1: Properties of Matter, Optics and Sound (For Maths)
Code	U21PH1ALT01
Course Type	Theory
Hours/Week	4
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*

TEXTBOOKS

1. Murugeshan R., Allied Physics, S. Chand & Co. Pvt. Ltd., New Delhi(2014).
2. Murugeshan R., Properties of Matter, S. Chand & Co. Pvt. Ltd., New Delhi(2017).
3. Brijlal and Subramanyam N., Hemne P. S., Heat, Thermodynamics and Statistical Physics, Revised Edition, S. Chand & Company Ltd, New Delhi(2012).
4. Subramanyam N., Brijlal and Avadhanulu M. N., Text Book of Optics, Revised Edition S. Chand & Co, New Delhi(2012).
5. 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

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

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**

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**

(For Candidates admitted in the Academic year 2021-2022)

Course Title	**BASIC PHYSICS PRACTICALS** (For Maths)
Code	**U21PH1ALP02**
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
3. http://ov-au.vlabs.ac.in/optics/Spectrometer_Refractive_Index/experiment.html
4. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/engg_physics/labs/exp1/simulation/simulator.html
5. 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 2021-2022)

Course Title	**ALLIED PHYSICS 1:DIGITAL ELECTRONICS (For Computer Science)**
Code	**U21PH1ALT03**
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.

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 2ndEdition (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 2021-2022)

Course Title	**Major Elective 1: Renewable Energy**
Code	**U21PH2MET02**
Course Type	**Theory**
Semester	**II**
Hours/Week	**4**
Credits	**3**
Marks	**100**

CONSPECTUS

To understand the fundamentals and applications of the various renewable energy resources.

COURSE OBJECTIVES:

1. To understand the distribution of energy resources and energy consumption.
2. To understand the principle of using solar energy for various applications.
3. To understand the mechanism of solar thermal energy conversion techniques.
4. To analyse the various wind resources and their applications and to understand the construction of OTEC plants and their working.
5. To analyse various bioenergy resources, their conversion techniques and applications.

UNIT I: THE ENERGY LANDSCAPE **12 Hrs**

Current Global Energy Use- Energy consumption in India-Non-renewable energy-Lifetime of Fossil Fuels-Sustainability and Energy Use- Sustainable Energy-Renewable Energy Sources- Types and Energy Conversion Technologies-Potential applications of renewable energy sources- Transport-Agriculture-Industry-Domestic and Energy Sector.

Extra reading / Key words: *Hydro power plant, Wind Mill*

UNIT II: SOLAR ENERGY **12 Hrs**

Solar Radiation- Measurements of Solar Radiation-Fundamentals of Solar Photo Voltaic Conversion- Photovoltaic cells and modules- Silicon-based Photovoltaics - DSSC-Improvements in solar cell efficiency over time-Solar PV Applications- Power in Space-Solar Farms.

Extra reading / Key words: *Solar City, Perovskite Solar Cell*

UNIT III: SOLAR THERMAL ENERGY **12 Hrs**

Solar thermal conversion: basics- Flat plate collectors-liquid and air type, Theory of flat plate collectors- Selective coatings-Advanced collectors: ETC, Solar Pond-Concentrators: optical design of concentrators- Solar water heaters, Solar dryers- Thermal storage- Active and passive heating of buildings- Solar thermal power generation.

Extra reading / Key words: *Solar cooling, Solar stills*

UNIT IV: WIND AND OCEAN ENERGY **12 Hrs**

The Wind Resource- Wind Energy Estimation-Types of Wind Energy Systems-Performance- Details of Wind Turbine Generator-Ocean Thermal Energy Conversion (OTEC)-OTEC resource- Principle of operation, development of OTEC plants-Potential and conversion techniques-Optimal hydrodynamic performance- mini-hydel power plants.

Extra reading / Key words: *offshore wind park, Wave Energy*

UNIT V: BIOENERGY **12 Hrs**

Biopower- bioheat - Biofuels, - Biobased products- Biomass Feedstocks- Agricultural waste - Forestry waste - Farm waste - Organic components of residential, commercial, institutional and industrial waste Biomass Conversion- Hydrolysis, enzyme - Fermentation-Anaerobic/aerobic digestion- Combustion- Pyrolysis- bio-gas, utilization for cooking.

Extra reading / Key words: *Bioenergy cycle, Bio-refineries*

TEXT BOOKS

1. Reneweble energy resources: Tiwari and Ghosal, Narosa publication.
2. Non conventional Energy Sources, Khanna Publication.

SUGGESTED READINGS

1. Renewable Energy Sources: Twidell& Weir, CRC Press.
2. Solar Energy/ S.P. Sukhatme, Tata McGraw-Hill.
3. Non Conventional Energy Systems: K M. Mittal, A H WheelerPublishing Co Ltd.
4. Renewable Energy Technologies: Ramesh & Kumar, Narosa publication.
5. Biomass Energy, Oxford &IBH Publication Co.

COURSE OUTCOMES:

The Leaner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO-1	list the various energy resources and the energy consumption.	K1
CO-2	compare various types of Solar cells and its applications and explain the mechanism of solar thermal energy conversion	K2
CO-3	explain the working of Wind turbine generator and OTEC plants.	K3
CO-4	compare the different types of bioenergy resources and their conversion techniques	K4

PO – CO MAPPING

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

PSO – CO MAPPING

	PSO1	PSO2	PSO3
CO 1			
CO 2			
CO 3			
CO 4			

(For Candidates admitted in the Academic year 2021-2022)

Course Title	MAJOR CORE 3:MAIN PRACTICALI-GENERAL PHYSICS PRACTICALS
Code	U21PH2MCP03
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.

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 2021-2022)

Course Title	MAJOR CORE 4: HEAT, THERMODYNAMICS AND STATISTICAL PHYSICS
Code	U21PH2MCT04
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.

UNIT I: KINETIC THEORY OF GASES (15 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, Di and polyatomic gas-Van der Waals' Equation of State- mean free path- application to atmosphere physics.

Extra reading/Key words: *Evaporation, thermionic emission*

UNIT II: THERMODYNAMICS (15 Hrs)

Thermodynamic system-Zeroth law of thermodynamic-Thermodynamic Equilibrium-Internal energy-First law of thermodynamics-Significance of the first law-Carnot's ideal heat engine–Second law of

thermodynamics- Internal combustion engine– Entropy – T-S Diagram – Maxwell's thermodynamic relations – Clausius and Claypeyron latent heat equations using Maxwell's relations-Thermodynamic potentials.

Extra reading / Key words: *Energy, State coordinates*

UNIT III: LOW TEMPERATURE PHYSICS (15 Hrs)

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: refrigerating machines-electroflux refrigerator-air conditioning machines-effects of CF_2 Cl_2 on Ozone layer.

Extra reading/Key words: *Temperature of inversion, Heat capacity*

UNIT IV: TRANSMISSION OF HEAT (15 Hrs)

Introduction-Transmission of heat-Thermal conductivity – Rectilinear flow of heat – experimental methods to determine the coefficient of thermal conductivity – Forbes's method and Lee's disc method – Kirchoff's law, Stefan's law and Newton's law of radiation – Black body radiation – Energy distribution in the black body spectrum-Solar constant- temperature of the sun-application of convection: central heating system.

Extra reading / Key words: *Conduction, Heat transfer*

UNIT V: STATISTICAL PHYSICS (15 Hrs)

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 – microcanonical, 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.clearitmedical.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**

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 2021-2022)

Course Title	**Allied Physics Paper 3:** **Modern Physics, Electricity and Electronics** (Maths)
Code	**U21PH2ALT04**
Course Type	**Theory**
Semester	**II**
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 understand the photoelectric effect in different cells in atomic physics.
2. To understand radioactivity, nuclear fission and fusion process in nuclear physics.
3. To analyze the basic concepts and properties of electricity.
4. remember the electromagnetism principles and apply them.
5. understand the semiconductor devices and its applications.

UNIT I: ATOMICPHYSICS 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: NUCLEARPHYSICS 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- electric flux - Gauss theorem and its applications (Intensity at a point due to a charged sphere & cylinder) - Principle of a capacitor- capacitance of a spherical capacitor with outer and inner sphere earthed - capacitance of a cylindrical capacitor - 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*

UNITIV:ELECTROMAGNETISM 12Hrs

Force on a current carrying conductor - Flemings left hand rule -Laws of electromagnetic induction –Self induction–Self inductance of a long solenoid - Mutual induction - coefficient of coupling - determination of coefficient of Self inductance by Anderson's method - 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 transistor in CE configuration - transistor as an amplifier - construction of AND, OR and NOT logical gates using diodes and transistors.

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

TEXT BOOKS

1. Murugeshan. R, Allied Physics, S. Chand & Co. Ltd, NewDelhi(2005).
2. Murugeshan, R, Modern Physics, S. Chand & Company Ltd, NewDelhi,(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 UniversityPress, 3rd edition(2013)
2. Kulkarni.S.Y, Somanathan Nair.B ,Shree Krishna Kumar.K, Basic Electronics, I K International Publishing House, Bengaluru(2011).
3. Jain, R.P., Modern Digital Electronics, Tata McGraw Hill India Ltd., NewDelhi, 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.deshbandhucollege.ac.in/pdf/resources/1585301881_PHY(H)- II-ElECTRICITY_MAGNETISM_&_EMT-16.pdf

https://www.britannica.com/technology/semiconductor-device/Metal-semiconductor-field-effect-transistors

COURSE OUTCOMES

The Leaner will be able to:

COs	CO Description	Cognitive Level
CO1	recall the basic concepts on fundamental of physics such as Modern physics, electricity, electromagnetism and electronics	K1
CO2	understand the theory and experiments on fundamental of physics such as Modern physics, electricity, electromagnetism and electronics.	K2
CO3	apply the theoretical knowledge on fundamental of physics to demonstrate the experiments and solve the real-time problems.	K3
CO4	analyze the experimental data and interpret the results obtained from the experiments on modern physics, electricity, electromagnetism and electronics.	K4

CO-PO Mapping

	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	M	M	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**

CO - PSO Mapping

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

(For Candidates admitted in the Academic year 2021-2022)

Course Title	INDUSTRIAL RELATIONS: PHOTOVOLTAIC SYSTEMS
Code	U21PH2IRT01
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.

TEXT BOOK

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 2021-2022)

Course Title	**MAJOR CORE 5: ELECTRICITY AND ELECTROMAGNETISM**
Code	**U21PH3MCT05**
Course Type	**Theory**
Semester	**III**
Hours/Week	**6**
Credits	**5**
Marks	**100**

CONSPECTUS

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

COURSEOBJECTIVES:

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 **18Hrs**

Coulomb's Law – Gauss's law and its applications (Electric Field due to a uniformly charged sphere, hollow cylinder & solid cylinder)-Poisson and Laplace Equations- Electric Potential – Potential at a point due to a uniformly charged conducting sphere- Principle of acapacitor-capacitanceofasphericalcapacitorwithouterandinnersphereearthed.-capacitance of a cylindrical capacitor- energy stored in a charged capacitor- Loss of energy on sharing of charges between two capacitors- Quadrant electrometer-measurement of ionization currents using the quadrant electrometer.

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

UNIT II: ELECTROMAGNETISM **18Hrs**

Force on a current carrying conductor-Fleming's left hand rule – forces between long conductors carrying current – Definition of Ampere – Biot Savart law-Applications:magneticfieldalongtheaxisofacircularcoilandsolenoid – Theory of ballistic galvanometer – correction for damping in ballistic galvanometer – charge sensitivity of a ballistic galvanometer-Application: Measurement of absolute capacity of a condenser– Ampere's circuital law -Applications : magnetic field inside a long solenoid.

Extra Reading/Keywords: *Magnetostatics,Electrodynamics,Potentialdifference,Torque,Magneticfield*

UNITIII: ELECTROMAGNETICINDUCTIONANDITSAPPLICATIONS **18Hrs**

Faraday's Laws of Electromagnetic induction – self and mutual induction-self-inductance of a solenoid- mutual inductance between two long coaxial solenoid- coefficient of coupling-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–Applications of Eddy currents: Induction Furnace, Speedometer and Electric Brakes –induction coil.

Extra Reading/Keywords: *Transformer*

UNITIV: ALTERNATING CURRENTS **18Hrs**

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 – power station–distribution of three phase alternating current-three phase four wire system- star connection – delta connection.

Extra Reading/Keywords: *Sine wave, Modulation*

UNIT V: ELECTRIC GENERATORSANDMOTORS **18 Hrs**

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. Ambrose and Vincent Devaraj, 5th Edition, Introduction to Electronics, (1992).

SUGGESTED READINGS

1. Narayanamoorthy&Nagaratnam,ElectricityandMagnetism,NPC,Chennai(1992).
2. Tiwari N .D, Electricity and Electromagnetism, Sultan and Chand Co., New Delhi(1998).
3. BrijlalandSubramanium,ElectricityandElectromagnetism,S.ChandandCo,NewDelhi(2000).
4. Arora C.L, Electricity and Magnetism, 16thEdition, S.Chand and Co.,New Delhi, (1999).
5. Tewari K K**,** Electricity & Magnetism, 3rdEdition,Kindle Edition(2007).

WEB REFERENCES

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

COURSE OUTCOMES:

The Leaner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO 1	Recall the fundamental laws in electricity and electromagnetism	K1
CO 2	understand the principles of capacitor, determination of self and mutual inductance, theory of B.G, choke coil & three phase system, working of generators and motors	K2

CO 3	Apply Gauss law to spherical and cylindrical bodies, theory of B.G to measure the absolute capacity of a capacitor, the principle of eddy current to speedometer and the principle of rotating magnetic field to induction motor.	K3
CO 4	Analyze the concepts of electricity and electromagnetism to Solve the real time problems.	K4
CO 5	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	PSO3
CO-1	**H**	**H**	**M**
CO-2	**H**	**H**	**M**
CO-3	**H**	**H**	**H**
CO-4	**H**	**H**	**M**
CO-5	**H**	**M**	**H**

(For Candidates admitted in the Academic year 2021-2022)

Course Title	MAJOR CORE 6: MAIN PRACTICAL II –OPTICS, ELECTRICITYAND ELECTRONICS PRACTICALS
Code	U21PH4MCP06
Course Type	Practical
Semester	III & IV
Hours/Week	3
Credits	4
Marks	100

CONSPECTUS:

To understand the basic laws of optics and 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 rotatory power of sugar solution using polarimeter.
3. To apply the basic concepts of electricity by doing experiments using B.G.
4. Toanalyzethecharacteristicsandapplicationsofelectronicdevicessuchasdiodesandtransisors.
5. To understand the basic knowledge of electronics by operating an OPAMP.

Any Sixteen Experiments Only

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. Determination of figure of merit of a Ballistic galvanometer.
5. Study of Series Resonant Circuits.
6. Study of Parallel Resonant Circuits.
7. Determination of the parameters – Frequency, Voltage peak, V_{rms}, Instantaneous Value, Peak Factor and Form Factor of sine waveform.
8. Determination of time constant (RC)of CR circuit.
9. Study of Characteristics of a Zener diode.

10. Construction and study of Regulated Power Supply using Zener Diode.
11. Construction and study of Bridge Rectifier with and without filter for various loads.
12. Study of Characteristics of JFET.
13. Study of transistor characteristics–common base configuration.
14. Study of transistor characteristics– common emitter configuration.
15. Construction and study of Half wave rectifier with and without filter.
16. Construction and study of Full Wave Rectifier with two diodes with and without filter.
17. Construction and study of Inverting and Non-inverting Amplifier using OP-AMP.
18. Construction and study of summing and Difference Amplifier using OP-AMP.
19. Construction and study of Differentiator and Integrator using OP-AMP.
20. Verification of Kirchhoff's laws.

SUGGESTED READINGS

1. Ouseph C.C. Rao U.J,. Vijayendran. V, Practical Physics and Electronics, S. Viswanathan (Printers and Publishers), Pvt., Ltd., First Edition 2007.

WEB REFERENCES:

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 rotatory 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 OP AMP.	K2
CO-3	apply the different configuration modes of transistor to determine the transistor parameters and the characteristics of OP AMP to construct OP AMP 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 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 – CO MAPPING

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 2021-2022)

Course Title	**BASIC PHYSICS – I** (for Chemistry)
Code	**U21PH3ALT05**
Course Type	**Theory**
Semester	**III**
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 (2nd 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
CO 5	Relate the properties of matter, light and heat with their behavior and connect them with the physical parameters involved.	K5

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**
CO-5	**H**	**H**	**M**	**M**	**H**	**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**
CO-5	**H**	**H**	**H**

(For Candidates admitted in the Academic year 2021-2022)	
Course Title	**MAJOR ELECTIVE2: GEOPHYSICS**
Code	**U21PH3MET03**
Course Type	**Theory**
Semester	**III**
Hours/Week	**4**
Credits	**3**
Marks	**100**

CONSPECTUS:

To develop an interest in the learning of geophysics and to understand about the features of geophysics from different methods such as seismic, magnetic and gravity methods.

COURSEOBJECTIVES:

1. To discuss the physics and geology of the earth through geophysical observation and measurements.
2. To empower students to understand the principles of applying geophysical methods to socially relevant problems, including natural hazards and other environmental issues.
3. To Study the fundamentals of geochronology and sources of heat within Earth.
4. To understand that movement of the Earth's liquid outer core causes the Earth's magnetic field and discuss the features of Earth's magnetic field.
5. To comprehend the concepts of interior and surficial processes of the Earth and other planets through analysis of elastic plate flexure and gravity

UNIT I: INTRODUCTION TO GEOPHYSICS 12Hrs

Earth as a member of the solar system – Atmosphere – Ionosphere –Asthenosphere – Lithosphere – Hydrosphere and Biosphere – Meteorology – Oceanography and Hydrology.

Extra Reading/Keywords: *Earth's surface, Environment*

UNIT II: GEOMAGNETISM 12 Hrs

Geomagnetism - Definitions, magnetic field, main field, external field and local anomalies, magnetic susceptibility of sun and planets- Magnetometer-Flux gate magnetometers –Optically pumped magnetometer- Dynamo theory of earth magnetism Magnetic surveying and its applications.

Extra Reading/Keywords: *Magnetic Aomaly, Secular variation*

UNIT III : SEISMOLOGY 12Hrs

The earth's interior and crust as revealed by earthquakes- Rayleigh waves and Love waves-Earthquakemagnitudeandintensity-Tsunami-CausesandImpacts-Tsunamiwarningsystems.

Extra Reading/Keywords: *Trembling movement of the earth's crust, Under water earthquake*

UNITIV: GEOCHRONOLOGYANDGEOTHERMALPHYSICS 12Hrs

Radioactivity of the earth-Radioactive dating of rocks and minerals-Geological time scale-The age of the earth. Flow of heat to the surface of the earth-Sources of heat within earth – Internal temperature of earth.

Extra Reading/Keywords: *Age determination, Earth's internal heat*

UNIT V: GEODYNAMICSANDAPPLICATIONSOF GEOPHYSICS 12Hrs

Plate dynamics-Earth's size and shape -Earth's rotation-Measurement of gravity on land and moving platform – Application of gravity methods.

Regional geophysics, oil and gas geophysics, ore geophysics and ground water geophysics

Extra Reading/Keywords: *Dynamic description, spatial dimension*

TEXT BOOKS:

1. M.B. Ramachandra Rao, Outlines of geophysical prospecting: a manual for geologists, University of Mysore(1975).
2. WilliamMurrayTelford, W.M.Telford,L.P.Geldart,RobertE.Sheriff,R.E.Sheriff,Applied Geophysics, 2nd Edition, Cambridge University Press,(1990).
3. Rama Rao B.S.,I VR Murthy, Gravity and magnetic methods of prospecting,4th Edition ,Arnold-Heinemann(1978).
4. Cook A.H, Physics of the Earth and Planets,4thedition, Mc Millan Press, London, (1973).

SUGGESTED READINGS:

1. George David Garland, Introduction to geophysics: mantle, core,andcrust,2ndEdition Saunders (1979).
2. William Lowrie, Fundamentals of Geophysics, 2nd Edition, Cambridge University Press,(2007).
3. John Raferty, Geochronology – Dating and Precambrian time- The beginning of the world as we know it, 7thEdition, Britannica Educational publishers, New York (2011).

WEB REFERENCE

1. https://archive.epa.gov/esd/archive-geophysics/web/html/references.html
2. https://www.wiley.com/en-us/

COURSE OUTCOMES:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO-1	Recall geology and geophysics	K1
CO-2	Understand the experimental details of Saturation induction magnetometers, dynamo theory of earth magnetism andmeasurement of gravity on land and moving platform	K2
CO-3	Apply the Radioactive dating to find the age of rocks, mineralsand earth	K3
CO-4	Analyze the impact of earthquake and tsunami using seismograph	K4
CO-5	Evaluate the data obtained from the geothermal, magnetic and seismic methods	K5

PO – CO MAPPING

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

(For Candidates admitted in the Academic year 2021-2022)

Course Title	Major Elective 1: Domestic Power Generation and House Wiring
Code	U21PH3MET04
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	Evaluate 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 – COMAPPING

	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 2021-2022)

Course Title	MAJOR SKILL BASED ELECTIVE 1: PHYSICS FOR LIFE SCIENCES
Code	U21PH3SBP01
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 2021-2022)	
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 2021-2022)	
Course Title	**NON MAJOR ELECTIVE 1: FUNDAMENTALS OF DIGITAL SYSTEMS AND COMPUTER ELECTRONICS**
Code	**U21PH3NMT01**
Course Type	**Theory**
Semester	**III**
Hours/Week	**3**
Credits	**3**
Marks	**100**

CONSPECTUS

To understand the fundamentals of digital system and basic ideas about digital computer and memories.

COURSE OBJECTIVES

1. To understand the rules Boolean algebra.
2. To understand about the binary number system and mutual conversion.
3. To understand the conversion of documents, sound, image and video into digits.
4. To analyze the different types of computers and the functions of CPU.
5. To understand the concepts of memories and their types.

UNIT I: DATA AND INFORMATION FEATURES OF DIGITAL SYSTEMS 9 Hrs

Number Systems-Decimal, Binary, Octal, Hexadecimal and their inter conversions, one's complement and two's complement, Binary Arithmetic

Extra Reading / Keywords: *BCD, 9's Complement.*

UNIT II: LOGIC GATES 9 Hrs

Basic gates-AND, OR, NOT gates, Universal gates- NAND and NOR gates, other gates- XOR, XNOR gates- Laws of Boolean Algebra- Algebraic simplification of Boolean expressions -De Morgan's theorems.

Extra Reading / Keywords: *Comparators, Parity Checkers*

UNIT III: DIGITIZATION 9 Hrs

Introduction, document digitization, sound digitization, Image digitization, video digitization.

Extra Reading / Keywords: *Image scanner, visual Audio*

UNIT IV: COMPUTER **9 Hrs**

Introduction –Generation of computers- Types of computers -Basic components of a digital computer-block diagram –CPU: Basic components of CPU.

Extra Reading / Keywords: *Keyboard and Mouse, input/output Devices*

UNIT V: MEMORIES **9 Hrs**

Basic Organization, Memory: ROM, RAM, PROM, EPROM, EEPROM, Secondary Memory: Hard Disk and optical Disk, Cache Memory, I/O devices.

Extra Reading / Keywords: *Magnetic tape, Hardware and Software*

TEXT BOOKS

1. Ram B. Fundamentals of microprocessors and microcomputer – 8th Edition, Dhanapat Rai Publications (P) Ltd, New Delhi (2013).
2. Floyd, Digital Fundamentals, 10th Edition, Pearson Education, India (2015).
3. Vijayendran V. Introduction to Integrated Electronics Digital and Analog, First Edition, S.Viswanathan (Printers & Publishers) Pvt., Ltd (2009).

SUGGESTED READINGS

1. Malvino. A and Leach, Digital Principles and Applications, 7th Edition, Mc-Graw Hill, New
2. Theraja B.L., Basic Electronics – Solid State-1st edition S. Chand and Company Limited, New Delhi, (2005).

WEB REFERENCE

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

COURSE OUTCOMES

The learners will be able to:

CO No.	Course Outcomes	Cognitive Level
CO-1	Recall number system conversion, basic logic gates, basic components of CPU and different types of memories	K1
CO-2	Convert binary into decimal, hexadecimal , octal, convert one complement and twos complement. Explain the concept of digitalization, block diagram of computer and memories	K2
CO-3	Apply the Boolean laws to solve Boolean expression , apply the concept of digitalization to convert sound , video and image digitization	K3
CO-4	Analyse various number systems, NAND and NOR as universal gates and compare the different types on memories.	K4
CO-5	Compare various conversion of number systems, logic gates, interpret Boolean laws to prove expressions.	K5

PO – CO MAPPING

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

(For Candidates admitted in the Academic year 2021-2022)

Course Title	Major Core 7: Electronics
Code	U21PH4MCT07
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 different types of diodes and their applications
2. To understand the action of transistors, configuration of transistor (CE) and action of transistor as an amplifier.
3. To explain the working and V-I characteristics of power devices such as UJT, SCR, JFET and MOSFET
4. To understand the importance of negative feedback amplifiers and explain different types of oscillator
5. To understand operational amplifier and its applications.

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 biasing - operating point and dc load line- stability factor- voltage divider bias Voltage divider bias frequency response - h parameters- Transistor as an amplifier- CE amplifier- two stage RC coupled amplifier - classification- Class A, Class B Class 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 wave SCR - Full wave SCR - JFET - drain and transfer characteristics- comparison between BJT and JFET - MOSFET: Depletion type MOSFET - drain and transfer characteristics-Enhancement type MOSFET - 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 .–oscillator – Barkhausen criterion – LC oscillators - amplifier as an oscillator - Types of Oscillator Hartley oscillator, Colpitt FET Oscillator – Wien - bridge oscillator.

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

UNIT V: OPERATIONAL AMPLIFIER AND APPLICATIONS 15 Hrs

Operational amplifier – differential amplifier – commom 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. Chattpadhyay D.C.,.Rakshit P.C, Saha B. and Purkait N.N.,Foundation of electronics,Wiley Eastern Limited, New Delhi, 2nd Edition (1988).
3. Narayana Rao B.V., Principles of Electronics, Vol III, Wiley Eastern and New Age International Limited, New Delhi, 2nd Edition (1992).

COURSE OUTCOMES

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO-1	Understand the function of different diodes, transistor , power devices, different oscillator and operational amplifier	K1
CO-2	Explain construction and working of diodes, transistor, power devices, oscillators and operational amplifiers	K2
CO-3	Classify different types of diodes, FET, oscillator , and amplifiers on the basics of their characteristics and applications	K3
CO-4	Analyze and compare the characteristics of various diodes , oscillators and power devices	K4
CO-5	Criticize the operating efficiency diodes, power devices oscillators and operational amplifiers ;	K5

CO-PO 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
CO 5	H	H	M	M	H	H	H	H	H

CO - PSO Mapping

	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	M	H	H

(For Candidates admitted in the Academic year 2021-2022)

Course Title	**BASIC PHYSICS PRACTICALS–I** (For Chemistry)
Code	**U21PH4ALP07**
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 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:

6. Ouseph C.C., Rao U.J., Vijayendran. V, Practical Physics and Electronics, S. Viswanathan (Printers and Publishers), Pvt., Ltd., (2007).
7. 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
6. http://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

COURSE OUTCOMES:

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
CO-5	Evaluate the various properties of matter, properties of light, logical operations and V-I characteristics of diodes through experiments.	K5

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**
CO-5	**H**	**H**	**M**	**M**	**H**	**H**	**H**	**H**	**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**
CO-5	**H**	**H**	**H**

(For Candidates admitted in the Academic year 2021-2022)

Course Title	**Allied Physics 6: Basic Physics – II** (for Chemistry)
Code	**U21PH4ALT08**
Course Type	**Theory**
Semester	**IV**
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 analyze 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 **12Hrs**

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-efficientofcoupling-determinationofself-inductancebyAnderson'smethod-experimentaldetermination of mutual inductance - experimental determination of horizontal intensity of earth's magnetic field using circular coil

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

UNIT II: ANALOG ELECTRONICS **12Hrs**

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/Key words: *Breakdown, Operational amplifier*

UNIT III: DIGITAL ELECTRONICS 12Hrs

Logic gates-construction of AND, OR & NOT gates using discrete components - NAND andNOR gates - Universal building blocks - De Morgan's theorem - Boolean algebra- Simplification ofBooleanexpressions(upto3variables)-Halfadder-Fulladder-Halfsubtractor.

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

UNITIV: 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/Key words: *Photons, Excitation*

UNITV: WAVE MECHANICS 12Hrs

Wave particle duality - De-Broglie wavelength - Davission and Germer's experiment - G.P Thomson experiment-Groupandphasevelocities-Wavepackets-Heisenberg'suncertaintyprinciple
-illustration of uncertainty principle.

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

TEXTBOOKS

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

SUGGESTED READINGS

1. Murugeshan. R, ElectricityandMagnetism, S.Chand&Co., NewDelhi(2019).
2. Malvino.AandLeach,DigitalPrinciplesandApplications,7thedition,Mc-GrawHill,NewYork(2011).
3. DavidHalliday,RobertResnik,KennetaS.Krane,ThePhysics, JohnWilleyaandsons,Singapore (2005).
4. GhatakandThyagarajan,LasersTheoryandapplication,MacmillanIndiaLtd.,(1997).
5. SathyaPrakash,QuantumMechanics, S.ChandandCompany,NewDelhi(2001).

WEBREFERENCES

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

CONo.	Course Outcomes	Cognitive Level
CO-1	Recall the principles of electromagnetism, types of semiconductors, Basic logic gates, characteristics and types of LASER, dual property of light	K1
CO-2	Explain the self and mutual induction of the coil, working of semiconductor diodes, NAND , NOR universal gates, construction and working of different LASERS, de Broglie wavelength	K2
CO-3	apply the basic laws of electromagnetic induction, operating efficiency of diodes , principles of Boolean algebra and logic gates, energy level of different LASER, and uncertainty principle to solve problems	K3
CO-4	outline and illustrate the basic concepts and importance of self and mutual induction, efficiency of diodes, logic gates, LASERS and wave mechanics with experiments and Verifications.	K4
CO-5	Criticize self and mutual induction, junction and zener diode, half and full adder , energy level of different LASER and group and phase velocities	K5

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
CO5	H	M	H	M	M	L	M	M	H

CO-PSO Mapping

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

(For Candidates admitted in the Academic year 2021-2022)

Course Title	**Allied Physics1:Biophysics** (for Biotech)
Code	**U21PH4ALT09**
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.

UNITI: 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*

UNITII: 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*

UNITIII: 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*

UNITIV: 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*

UNITV: 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.

SUGGESTEDREADINGS

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 (WavelandPress,2009).
4. L. Stryer, Biochemistry,W.A.Freeman and Co (1981).

WEB REFERENCES

1. https://www.grc.nasa.gov/www/k12/airplane/thermo.html#:~:text=Thermodynamics%20is%20a%20branch%20of,observe%20and%20measure%20in%20experiments
2. https://www.livescience.com/47446-fluid-dynamics.html
3. https://www.wired.com/2015/11/what-computational-physics-is-really-about/
4. https://byjus.com/physics/optics/

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 – COMAPPING

	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 2021-2022)

Course Title	ALLIED PHYSICS 2: BIOPHYSICS PRACTICALS (for Biotech)
Code	U21PH4ALP10
Course Type	Practical
Hours/Week	4
Credits	2
Marks	100

CONSPECTUS

To understand the various techniques and concepts in biophysics by relevant experiments.

COURSEOBJECTIVES

1. To understand the basics function of lenses by finding the focal length of lenses.
2. To apply the method of wave form generations and analyze the formation of Lissajous figures.
3. To apply the basic principles of optics to determine the refractive index of a material of a prism and for the given liquid using spectrometer.
4. To apply the concept of viscosity to find and compare the viscosities of liquids.
5. To apply the theoretical model techniques and analyze the biomolecular structures.
6. To analyze the protein structures using Ramachandran plot

Any Twelve experiments only

1. Focal length of convex.
2. Focal length of concave.
3. Waveform generation using AFO.
4. Lissajous figures.
5. Determination of density using Hare's apparatus.
6. Determination of surface tension of liquid by drop weight method.
7. Determination of refractive index of a solid prism.
8. Determination of refractive index of a given liquid as a criterion for its purity.
9. Determination of observed rotation α, specific rotation[α]and molar rotation [m'] for Sugar solution using polarimeter.
10. Using Ostwald viscometer, determine the coefficient of viscosity ηof fluids.
11. To study the Ramachandran plot using VMD.
12. Lattice constants (Cell) refinement using first-principal calculation (DFT).
13. Molecular modelling of lipid bilayers using VMD.

14. To study the simple molecular structures using basic molecular modelling software.

15. To study the protein structure prediction using VMD.

COURSE OUTCOMES:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO1	recall the basic properties of liquids, light and list out the molecular modelling softwares.	K1
CO2	understand the properties of liquids such as viscosity, density etc., and light namely, refraction and polarization.	K2
CO3	apply the properties of liquid, sound and light to determine the surface tension of liquid, viscosity of liquid, focal length of lens and power of lens.	K3
CO4	analyse the results obtained from the CRO, polarimeter, hollow prism experiments and Ramachandran plots for protein structures.	K4
CO5	justify the application of molecular modelling tool and dynamic method for studying the structural conformation of biomolecules.	K5

PO – CO MAPPING

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

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO1	**M**	**M**	**H**
CO2	**M**	**H**	**H**
CO3	**M**	**H**	**H**
CO4	**H**	**H**	**H**
CO5	**H**	**H**	**H**

(For Candidates admitted in the Academic year 2021-2022)

Course Title	**Allied Physics 3: Fundamentals of Microprocessor INTEL 8085** (for Computer Science)
Code	**U21PH4ALT11**
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 concepts of memory devices.
2. To understand the various parts of microprocessor in Architecture of INTEL 8085 and apply the five instruction set groups in Instruction set of INTEL8085.
3. To understand, apply and write simple programs for basic arithmetic and logical operations using the instruction set of INTEL 8085 in Programming of Microprocessor.
4. To understand interfacing techniques involved in INTEL8085.
5. To understand the applications of INTEL 8085 such as digital display, traffic control, generation of square wave and water level indicator in Microprocessor Applications.

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*

UNITII: 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: *Program to subtract two 16-bit numbers, Program to alter the contents of flag register*

UNIT IV: INTERFACING TECHNIQUES 12 Hrs

Addressspacepartitioning–DatatransfersScheme-synchronousdatatransfer–Asynchronousdata transfer –Interrupt driven data transfer- Interrupts of Intel 8085 – Programmable peripheral interface - Architecture of Intel 8255 – Architecture – Operating modes-Control word-Programmable DMAcontroller-Intel8257.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 micro computer –8thEdition, Dhanapat Rai Publications (P) Ltd, New Delhi (2013).

SUGGESTEDREADINGS

1. Ramesh Gaonkar, Microprocessor: Architecture, Programming andApplicationswith8085,6th Edition, Penram International Publishing (India)Pvt. *Ltd*. Mumbai(2013).
2. Nagoor KaniA., Microprocessors and Microcontrollers, 1stEdition, RBA Publications, Chennai(2017).

WEBREFERENCES

1. https://www.vssut.ac.in/lecture_notes/lecture1423813120.pdf
2. https://www.tutorialspoint.com/microprocessor/microprocessor_tutorial.pdf
3. 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 concepts of memory devices and the various parts of architecture of INTEL 8085, INTEL 8255 and instruction sets.	K1
CO-2	Explain the purpose of various pins of INTEL 8085, addressing modes, Concepts of shifting, complementing, operating modes of INTEL 8255,importance of delay subroutines	K2
CO-3	apply instructions of different group, data transfer scheme and delay subroutine using one register, two registers and register pair to write programs.	K3
CO-4	Distinguish instructions of different group, delay subroutine using one register, two register and register pair to design program for various applications	K4
CO-5	Evaluate the performance of memory devices, registers in microprocessor and digital electronic systems	K5

CO-PO Mapping

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

(For Candidates admitted in the Academic year 2021-2022)

Course Title	**Allied Physics 2: Digital and Microprocessor Practicals** (for Computer Science)
Code	**U21PH4ALP11**
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 and analyze the working of basic digital circuits using digital kits.
2. To understand and analyze the working of counters and registers using digital kits.
3. To create combinational circuits like Flip flops and verify their truth tables.
4. To understand and analyze the various microprocessor programs.
5. To skill development-practical exposure.

Any Sixteen Experiments Only

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. Construction of mod counters using IC 7490.
11. Study of Multiplexer and Demultiplexer using ICs.
12. Microprocessor – Programming for addition and subtraction.
13. Microprocessor – Programming for identifying the largest and smallest number from a series.

14. Microprocessor – Programming for arranging the numbers in Ascending and descending orders.
15. Microprocessor – Sum of series of 8 bit numbers whose sum is 8 bit and 16bit.
16. Interfacing of INTEL 8255 with Microprocessor.
17. Microprocessor – Programming for multiplication and division.
18. Microprocessor – Programming for code conversion.
19. Microprocessor – Programming for block transfer.
20. Microprocessor – Programming for Rolling Display.

SUGGESTED READINGS

1. Ouseph C.C. RaoU.J,. Vijayendran.V, Practical Physics and Electronics, S.Viswanathan (Printers and Publishers), Pvt., Ltd., First Edition 2007.

WEBREFERENCES

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	explain the working of basic digital circuits using digital kits;	K1
CO-2	understand and analyze the working of counters and registers using digital kits;	K2
CO-3	construct combinational circuits like Flip flops and verify their truth tables;	K3
CO-4	execute various assembly language programs;	K4
CO-5	skill development-practical exposure.	K5

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
CO-5	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
CO-5	H	H	H

(For Candidates admitted in the Academic year 2021-2022)

Course Title	MAJOR ELECTIVE 3: CIRCUIT AND NETWORK ANALYSIS
Code	U21PH4MET05
Course Type	Theory
Semester	IV
Hours/Week	4
Credits	3
Marks	100

CONSPECTUS

To understand the basic concepts of circuits and networks, network theorems and apply them to solve the problems.

COURSE OBJECTIVES

1. To remember, understand and apply the concepts of Kirchoff's laws
2. To remember, understand and apply the different methods to analyze the electrical circuits
3. To understand, apply, and analyze the theorems in circuit analysis
4. To remember, understand and apply the concepts of alternating currents and voltages
5. To understand and apply the theorems and different methods to analyze the AC circuits

UNIT I: KIRCHOFF'S LAWS 12 Hrs

The circuit – Resistance parameter – Inductance parameter – Capacitance parameter –Energy sources – Kirchoff 's Voltage law – Voltage division - Power in series circuit – Kirchoff's current law – Parallel resistance – Current division – Power in parallel circuits.

Extra Reading / Keywords: *Kirchhoff's Junction Rule, Kirchhoff's Loop Rule*

UNIT II: METHODS OF ANALYSING RESISTIVE CIRCUITS 12 Hrs

Mesh analysis – Mesh equation by inspection method – Super Mesh analysis – Nodal analysis – Nodal equation by inspection method – Super Node analysis - Source transformation technique – Star-Delta transformation technique.

Extra Reading / Keywords: *Verifications of the result using MATLAB &P Spice*

UNIT III: THEOREMS IN CIRCUIT ANALYSIS 12Hrs

Superposition theorem – Thevenin's theorem – Norton's theorem – Reciprocity theorem

- Compensation theorem – Maximum power transfer theorem – Duals and duality – Millman's theorem.

Extra Reading / Keywords: *Tellegen's theorem, Miller's Theorem*

UNIT - IV: ALTERNATING CURRENTS AND VOLTAGES 12 Hrs

The sine wave – Angular relation of a sine wave – The sine wave equation – Phase Relation in a pure resistor – Phase relation in a pure capacitor – Phase relation in a pure inductor – Series circuits – Parallel circuits – Compound circuits.

Extra Reading / Keywords: *Sine wave, Modulation*

UNIT V: STEADY STATE AC ANALYSIS

Mesh analysis – Mesh equation by inspection – Nodal analysis – Nodal equation by inspection– Superposition theorems – Thevenin's theorem – Norton's theorem – maximum power transfer theorem.

TEXT BOOKS

1. Sudhakar. A, Shyam Mohan S.P., Circuit And Networks - Analysis And Synthesis, 5th edition, McGraw Hill Education, (2017).
2. William H. Hayt JR., E. Kemmerly, Jamie D. Phillips, Steven M. Durbin, Engineering Circuit Analysis, 9th Edition, McGraw Hill Education; (2020)

SUGGESTED READINGS

1. Paranjothi S.R., Electrical circuit analysis, 4th edition New age publishers, (2011).
2. Dr. Bolton A.G., Dr. Jain L.C., Prof. Mithal A.K., Networks and systems, Khanna Publishers,New Delhi.

WEB REFERENCES

1. https://www.tutorialspoint.com/network_theory/index.html
2. https://www.allaboutcircuits.com/textbook/direct-current/chpt-6/kirchhoffs-voltage-law-kvl/
3. https://www.electricaltechnology.org/2021/05/superposition-theorem.html

COURSE OUTCOMES

The Leaner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO -1	state Kirchoff's laws, voltage and current division rules, different theorems and explain different methods of analyzing dc and ac circuits, phase relations in different circuits	K1
CO - 2	Discuss different methods of analyzing circuits, theorems, sine wave, series and parallel circuits.	K2
CO - 3	apply kirchoff's laws, voltage and current division rules, theorems to solve problems having the components in series and parallel form	K3
CO - 4	Analyse different types of circuits, compare and relate them in day today life.	K4
CO-5	Evaluate node voltages and currents in different branches by applying theorems and rules and justify the results.	K5

CO-PO Mapping

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

CO - PSO Mapping

	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	M	H	H

(For Candidates admitted in the Academic year 2021-2022)

Course Title	Major Elective 4 (for II BCA): SENSORS
Code	U21PH4MET06
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

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

Thermoelectric Sensors – Pyroelectric Sensors – Piezoelectric Sensors – Piezo resistive Sensors – Capacitive and Inductive Sensors.

Extra Reading / Keywords: *semiconductor sensor, thermistors*

UNIT III: OPTICAL SENSORS

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

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

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

UNIT V: APPLICATIONS OF SENSORS

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.

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_Automation_Control_Systems_Book_Series_Advances_in_Sensors_Reviews_Vol_4

COURSE OUTCOMES:

The Learner will be able to:

Co's	CO Description	Cognitive Level
CO1	remember 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 various types of sensors in the fields of medicine, commercial industry and research.	K4
CO5	evaluate the importance 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	H	H	H	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 2021-2022)

Course Title	Non Major Elective2:Explore the Universe
Code	U21PH4NMT02
Course Type	Theory
Semester	IV
Hours/Week	3
Credits	3
Marks	100

GENERALOBJECTIVE

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

COURSEOBJECTIVES

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

UNIT I: UNIVERSE **9Hrs**

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

Extra Reading/Keywords: *Parallel Universe, Multiverse*

UNIT II: PLANETARYSYSTEM **9Hrs**

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/Keywords: *Features of Mars, Dwarf Planet*

UNIT III: THE SUN **9Hrs**

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 /Keywords: *The Moon, Lunar Eclipses*

UNIT IV: CELESTIAL BODIES **9Hrs**

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/Keywords: *Kuiper belt, Earth's atmosphere*

UNITV: SPACEEXPLORATION **9Hrs**

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

Extra Reading/Keywords: *Spacesuit, Astronauts and Cosmonauts*

TEXTBOOK

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

SUGGESTEDREADINGS

1. Neilde Grasse, Tyson Cosmos With A New Foreword,(2013).
2. Neilde Grasse Tyson, Astrophysics for People in a Hurry,W. W. Norton Company, (2017).

WEBREFERENCES

1. **https://www.britannica.com/science/universe**
2. **https://solarsystem.nasa.gov/solar-system/sun/overview/**
3. **https://www.nasa.gov/**

COURSE OUTCOMES

The Learner 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 2021-2022)

Course Title	MAJOR CORE 8: CLASSICAL AND QUANTUM MECHANICS
Code	U21PH5MCT08
Course Type	Theory
Semester	V
Hours/Week	5
Credits	5
Marks	100

CONSPECTUS:

To gain knowledge about fundamentals of classical and quantum mechanics and to appreciate the link between them.

COURSEOBJECTIVES:

1. To recall the fundamental concepts and laws of mechanical systems.
2. To understand the fundamental concepts in Classical Mechanics and rigid body dynamics.
3. To understand the need of obtaining solution to complex mechanical problems by applying Lagrangian and Hamiltonian formalism rather than Newton formalism.
4. To employ Lagrangian and Hamiltonian formalism to solve the dynamical problems.
5. To describe the new branch of mechanics to provide framework for the phenomena's which could not be explained by classical mechanics.
6. To apply the Schrodinger equations to solve simple problems.

UNITI: LAGRANGIANDYNAMICS 15 Hrs

Introduction- Mechanics of a system of particles: External and internal forces–Centre of mass-Conservation of Linear momentum- Conservation of Angular momentum -ConservationofEnergy-Co-ordinatesystems-Degreesoffreedom-Constraints-Generalized coordinates- Principle of virtual work- D' Alembert's principle - Lagrange's equation from D'Alembert's principle – Procedure for formation of Lagrange's equations-Applications of Lagrange's equation: simple pendulum - Atwood's machine – compound pendulum-Lagrange's equations in presence of non-conservative forces.

Extra Reading/Key words: **Generalized potential, gyroscopic forces**

UNITII: HAMILTONIANDYNAMICS 15Hrs

Generalized momentum and Cyclic co-ordinates – Hamiltonian function H and conservation of energy: Jacobi's integral – conservation of energy-Physical significance –Hamilton's equations - Examples in Hamiltonian dynamics: Harmonic oscillator - Motion of a particle in a central force field-Hamilton's principle- Δ-variation-Principle of least action –Canonical transformations-Poisson brackets.

Extra Reading/Key words: **Noether's theorem, Routhian**

UNIT III: RIGID BODY DYNAMICS 15Hrs

Generalized coordinates of a rigid body– Body and space reference systems–Euler's angles-Angular momentum and inertia tensor-Principal axes-Principal moments of inertia-Euler's equations of motion for a rigid body -Torque free motion of a rigid body- Motion of a heavy symmetrical top: Steady precession and nutation-applications.

Extra Reading/Keywords: **Coriolis force, Gyroscope**

UNIT IV: FOUNDATION OF QUANTUM MECHANICS 15 Hrs

Limitations of classical Mechanics – Black body radiation – Photoelectric effect – Compton effect – Matter waves – Wave particle duality – de Broglie wavelength –Relation between phase velocity and group velocity – Experimental study of matter waves :Davison and Germer's experiment – G.P. Thomson experiment- Two slit interference pattern with electrons – Heisenberg's uncertainty principle – Illustrations: Determination of position with gamma ray microscope – Diffraction of a beam of electrons by a slit.

Extra Reading/Keywords: *Electron microscope*

UNIT V: SCHRODINGER EQUATION AND ITSAPPLICATIONS 15Hrs

Wave function–Physical significance of wave function and its requirements– postulates of wave mechanics – Eigen values and Eigen functions – Operators – Derivation of time dependent and time independent form of Schrodinger equations – Applications : Free particle – Particle in a box – Potential step – Barrier penetration problem – Tunnel effect –Linear harmonic oscillator.

Extra Reading/Key words: *Hydrogen atom, Rigid rotator*

TEXTBOOKS

1. Upadhyaya J.C, Classical Mechanics,3rdrevised edition, Himalaya publishing house, (2019).
2. Chatwal and Anand, Quantum mechanics, Himalaya Publishing House,(2012).
3. Sathya Prakash, Quantum Mechanics, S. Chand & Company, New Delhi,(2012).

BOOKSFORREFERENCE

1. Goldstein H, Poole C.P. and Safko J, Classical Mechanics, Pearson Education, New Delhi, (2013).
2. Rana N C and JoagP.S, Classical Mechanics, Tata Mc-Graw Hill, New Delhi, (2017).
3. Leonard I. Schiff and Jayendra B and hyopadhyay, Quantum Mechanics,4th Edition, Tata McGraw Hill Education, (2017).
4. Mathews,PM&Venkatesan,K,Atextbookofquantummechanics,2nd edition, Tata Mc Graw Hill Pvt., Ltd., New Delhi,(2017)
5. Richard L. Liboff, Introductory Quantum Mechanics, Pearson Education India,4th Edition,(2009).

WEBREFERENCES

1. https://nptel.ac.in/courses/115106123
2. https://physics.iitm.ac.in/~sriram/professional/teaching/courses/at-iitm/cp-july-november-2012.pdf
3. https://nptel.ac.in/courses/115101107
4. http://www.infocobuild.com/education/audio-video- courses/physics/quantum- mechanics-and-applications-iit- delhi.html

COURSE OUTCOMES:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO1	recall the fundamental concepts in Classical Mechanics and quantum mechanics.	K1
CO2	understand the conservation laws, Lagrangian and Hamiltonian formalism and rigid body dynamics for a mechanical system. Understand the postulates of wave mechanics and failure of classical mechanics.	K2
CO3	apply the Lagrangian and Hamiltonian formalism to solve the mechanical problems. Apply the Schrodinger equations to solve the simple microscopic problem.	K3
CO4	analyze the different formalism used to solve the mechanical problems.	K4
CO5	justify the application of Lagrangian and Hamiltonian formalism rather than Newton formalism in most of the cases.	K5
CO6	formulate the Lagrangian and Hamiltonian for a given real time mechanical problems. Estimate the wavefunctions of the physical systems based on the shape of the potential.	K6

PO – CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	H	L	H	H	M	H	H	H
CO2	H	H	L	H	H	M	H	H	H
CO3	H	H	M	H	H	M	H	H	H
CO4	H	H	M	H	H	M	H	H	H
CO5	H	H	M	H	H	M	H	H	H
CO6	H	H	M	H	H	M	H	H	H

PSO – CO MAPPING

	PSO1	PSO2	PSO3
CO1	H	H	L
CO2	H	H	L
CO3	H	H	M
CO4	H	H	M
CO5	H	H	M
CO6	H	H	H

(For Candidates admitted in the Academic year 2021-2022)

Course Title	MAJOR CORE 9: ATOMIC AND MOLECULAR PHYSICS
Code	U21PH5MCT09
Course Type	Theory
Semester	V
Hrs/Week	5
Credits	4
Marks	100

CONSPECTUS:

To understand the outgrowth of the atomic and molecular structure and the origin of their Characteristic spectra.

COURSE OBJECTIVES:

1. To understand the concept of Photoelectric effect and X rays
2. To remember the atom model, atomic spectra and importance of Pauli's exclusion principle
3. To apply electric and magnetic field, understand the observed dependence of atomic fine structure of spectral lines
4. To understand the principles, classify the types and analyze the application of lasers in laser physics
5. To understand the selection rules for vibrational transitions in terms of the symmetries of molecular vibration in molecular spectra

UNIT I: PHOTOELECTRIC EFFECT AND X-RAYS 15 Hrs

Photoelectric effect-Richardson and Compton experiment-Experimental investigation on the photoelectric effect-Lawsofphotoelectricemission-Einstein'sphotoelectricequation-Experimentalverification-Millikan'sexperiment-Photoelectriccells-ApplicationsofPhotoelectriccells-X-rays-PropertiesofX-rays-X-rayspectra-continuousspectrum-characteristics spectrum-Moseley's law and its importance-Comptoneffect:derivationofexpressionforchangeinwavelength – experimental verification.

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

UNIT II: ATOM MODEL & ATOMOIC SPECTRA 15 Hrs

Bohr atom model- Vector atom model- Quantum numbers associated with vector atom model-coupling schemes-Electronic configuration of elements and periodic table-Pauli's exclusion principle-Magnetic dipole moment due t orbital and spin motion of the electron-Stern and Gerlach experiment-Optical spectra-Spectral terms and notations selection rules-intensity rule and interval rule-Fine structure of sodium D lines

Extra Reading/Keywords: *Atom, Quantization*

UNIT III: FINE STRUCTURE OF SPECTRAL LINES 15 Hrs

Zeemaneffect-Experimentalarrangementforthenormal Zeemaneffect-Classicaltheoryofnormal Zeemaneffect-expressionfortheZeemanshift-Larmor's theorem -Quantum mechanical explanation of the normal Zeeman effect-Anomalous Zeeman effect-Paschen-Back effect- stark effect-experimental study-results

Extra Reading/Key words: *Magnetic field, hyperfine effect*

UNIT IV: MOLECULAR VIBRATIONS 15 Hrs

Normal modes of vibration-Classification of the normal modes-symmetry types of the normal modes - selection rules for vibrational transitions –Density Functional Theory-Optimized parameters-

Molecular orbital theory-Bonding and antibonding orbital

Extra Reading/Keywords: *Energy state, basis set*

UNIT V: LASER PHYSICS **15 Hrs**

Laser-Propertiesoflaserbeam-Spontaneousemission-Stimulatedemission- Principleoflaser-Populationinversion-Einsteincoefficients-PumpingMethods-Pumping schemes-Optical resonator-Nd:YAG laser- Rhodamine B laser-CO_2laser - Holography-Applications of laser in Medicine and Industry

Extra Reading/Keywords: *Photons, Excitation*

TEXTBOOKS

1. Rajam J.B., Atomic Physics, S.Chand &Co Ltd., New Delhi (2009).
2. Arul Dhas G., Molecular structure and spectroscopy, 2nd Edition, PHIL earning private limited (2008).
3. Colin N. Banwell & Elaine M. Mc Cash, Fundamentals of Molecular spectroscopy, 4th Edition, Tata Mc Graw Hill, New Delhi(2016).
4. SathyaNarayana D. N., Vibrational spectroscopy - Theory and Applications, 1st Edition, New Age International Publishers, New Delhi (2004).

SUGGESTED READINGS

1. Sehgal, Chopra and Sehgal, Modern Physics,9th edition, Sultan Chand & Sons, New Delhi(2004).
2. Arora C.L, Atomic and Molecular Physics,1st Edition, S. Chand & Co Ltd., New Delhi(1999).
3. Ghosal S.N, Atomic Physics, S. Chand & Co Ltd., New Delhi (2004).
4. Gupta S.L., Kumar, V. Sharma, H.V, Elements of spectroscopy,29th Edition, Pragati Prakashan, Meerut, Uttar Pradesh (2017).
5. Mathews Venkatesan, K, A text book of quantum mechanics, 2nd edition, Tata McGraw-Hill publishing company Ltd., New Delhi(2010).
6. Murugesan R, Siva Prasath Murugesan, Modern Physics,14th Revised Edition, S. Chand & Co Ltd., New Delhi (2014).

WEBREFERENCE

1. https://iopscience.iop.org/book/978-1-64
2. https://www.britannica.com/technology/laser/Laser-applications
3. http://www.pas.rochester.edu/~blackman/ast104/zeeman-split.html

COURSE OUTCOMES:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive level
CO 1	recall Laws of photoelectric emission, atom models, fine structure of spectral lines, principle of laser and normal Modes of vibration	K1
CO 2	understand classical theory of normal Zeeman effect, pumping methods and symmetry types of the normal modes	K2
CO 3	apply the concept of vector atom model to explain the fine structure of spectral lines	K3
CO 4	analyze electronic configuration of elements and selection rules for vibrational transitions	K4
CO 5	evaluate the optimized parameters in molecular vibration using DFT.	K5
CO 6	generate three dimensional image using holography technique	K6

PO - CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	M	H	H	H	H	M	M	M	H
CO2	H	H	H	M	M	M	L	M	L
CO3	H	M	M	M	L	L	L	H	L
CO4	H	H	H	M	L	M	L	H	L
CO5	H	H	H	M	M	L	L	H	L
CO6	H	H	H	H	H	M	H	H	H

PSO - CO MAPPING

	PSO1	PSO2	PSO3
CO1	H	M	L
CO2	H	M	M
CO3	H	H	M
CO4	H	H	H
CO5	H	H	H
CO6	H	H	H

(For Candidates admitted in the Academic year 2021-2022)

Course Title	MAJOR CORE 10:MAIN PRACTICAL III: ADVANCED ELECTRONICS & DIGITAL PRACTICALS
Code	U21PH5MCP11
Course Type	Practical
Semester	V
Hours /Week	6
Credits	5
Marks	100

CONSPECTUS: To understand the basic role of various components in electronic circuits, to build the circuits such as amplifiers, oscillators, to study the basic digital circuits and to do simple programs in microprocessor.

COURSE OBJECTIVES:

1. To remember the working of basic digital circuits using ICs.
2. To understand simple programs in microprocessor usingINTEL8085.
3. To understand the operations of various Oscillators.
4. To apply operational amplifier to determine the basic parameters.
5. To analyze the frequency response characteristics of an amplifiers.

LIST OF EXPERIMENTS

1. Construction& Study of Voltage doubler.
2. Design & Study of clipping and clamping circuits.
3. Construction & Study of a Single stage amplifier using transistor.
4. Construction& Study of Hartley Oscillator using transistor.
5. Construction& Study of Colpitt's Oscillator using transistor.
6. Study the characteristics of LDR.
7. Determination of OP-AMP parameters: open loop gain, closed loop gain, input impedance and output impedance.
8. Study of IC chips and verification of De Morgan's theorems.
9. Study of NAND & NOR as Universal building blocks.
10. Study of Encoders and Decoders.
11. Karnaugh Map– Simplification of Boolean expression.
12. Construct Half adder, Half Subtractor and Full adder circuits using logic gates.
13. Microprocessor–Programming for addition and Multiplication.
14. Microprocessor–Programming for Subtraction and Block transfer.
15. Study of UJT Characteristics.
16. Study of Mod-n Counters using IC 7473.

BOOKS FOR REFERENCES:

1. Ouseph C.C. RaoU.J,. Vijayendran. V, Practical Physics and Electronics, S. Viswanathan (Printers and Publishers), Pvt., Ltd., First Edition 2007.

WEB REFERENCES:

1. http://vlabs.iitb.ac.in/vlabs-dev/labs_local/digital_application/labs/exp14/simulation.php
2. http://vlabs.iitb.ac.in/vlabs-dev/labs/digital-electronics/experiments/verification-decoder-demultiplexer-encoder-iitr/simulation.html
3. https://he-coep.vlabs.ac.in/Experiment5/index1.html
4. http://vlabs.iitkgp.ernet.in/be/exp17/index.html#
5. http://vlabs.iitkgp.ernet.in/be/exp13/index.html#
6. http://vlab.amrita.edu/?sub=1&brch=201&sim=1142&cnt=1
7. http://vlabs.iitb.ac.in/vlabs-dev/labs_local/microprocessor/labs/explist.php

COURSE OUTCOMES:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO 1	recall the digital principles and instructions of Microprocessor INTEL 8085.	K1
CO 2	understand the characteristics of electronic devices.	K2
CO 3	apply the digital principles to study the combinational and arithmetic circuits.	K3
CO 4	analyze the characteristics of LDR, UJT a n d c lipping clamping circuits.	K4
CO 5	evaluate the parameters of Op – amp using IC 741.	K5
CO 6	construct the logic circuit by simplifying the boolean expressions using K – map.	K6

PO – COMAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	H	H	M	L	H	M	H	M
CO2	H	H	H	M	L	M	H	M	H
CO3	M	H	H	M	L	H	H	M	M
CO4	M	H	H	M	L	M	H	H	H
CO5	M	H	H	M	M	M	H	H	H
CO6	M	H	H	M	M	M	H	H	H

PSO – CO MAPPING

	PSO1	PSO2	PSO3
CO1	**H**	**H**	**L**
CO2	**H**	**H**	**M**
CO3	**H**	**H**	**H**
CO4	**H**	**H**	**H**
CO5	**M**	**H**	**H**
CO6	**M**	**H**	**H**

(For Candidates admitted from the academic year2021–22onwards)

Course Title	MAJOR CORE 11: DIGITAL ELECTRONICS
Code	U21PH5MCT12
Course Type	Theory
Semester	V
Hours/Week	4
Credits	4
Marks	100

CONSPECTUS:

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

COURSE OBJECTIVES:

1. To remember and learn the number systems, code conversions, arithmetic operations and the basics of logic gates.
2. To understand the combinational circuits: multiplexer, demultiplexer, encoder and decoder, basic of counters and registers.
3. To apply the basic digital principles for the simplification of Boolean equations using Karnaugh map and Quine Mc Cluskey methods.
4. To analyze the different sequential circuits and registers.
5. Evaluate and correlate the concepts of analog/digital converters with the applications.
6. Create new circuits using the simplification of Boolean logic equation.

UNIT I: DIGITAL FUNDAMENTALS &LOGIC GATES 12 Hrs

Introduction to Number Systems - Codes: Binary, BCD, Gray, Alphanumeric codes - Code conversions: binary to decimal & hexadecimal, decimal to hexadecimal & binary, hexadecimal to binary & decimal -Binary addition, subtraction, - 1's and 2'scomplement- Boolean theorems, Laws of Boolean algebra- De-Morgan's theorem.
Basic logic circuits: AND, OR, NOT, NAND, NOR, Ex-OR and their truth tables-NAND and NOR as Universal gate– Basics of TTL, ECL, MOS and CMOS.

Extra reading/Key words: *Binary multiplication, Binary division*

UNIT II: SIMPLIFICATION OF BOOLEAN EQUATIONS 12 Hrs

Boolean expressions for gate networks — Min terms- Karnaugh map forming up to four variables - Simplification using Karnaugh map- Don't care conditions- Max terms – K map using max terms- Quine Mc Cluskey method of minimization.

Extra reading/Keywords*: Digital circuit designing, CD players*

UNIT III: COMBINATIONALCIRCUITS 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.

Extra reading/Key words: *Digital communication, Calculators*

UNIT IV: SEQUENTIAL CIRCUITS & REGISTERS 12 Hrs

Flip Flops: SR Flip Flop, Clocked SR Flip Flop, D Flip Flop, JK Flip Flop, JK Master slave Flip Flop (Edge Triggering) and T Flip Flop.

Registers- Shift registers– Series and Parallel Shift registers–Application of Shift registers.

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

UNIT V: COUNTERS & ANALOG / DIGITAL CONVERTERS 12 Hrs

Ring Counter–Ripple counter-Asynchronous counters-Synchronous counters –Decade counters-application of counters.

A/D and D/A converters - R/2R ladder- D/A converter -Dual Slope A/D converter –Successive Approximation A/D Converter- Accuracy and resolution of converters-Applications of A/D and D/A converters.

Extra reading/Keywords: *Computers, Data storage systems.*

TEXT BOOKS:

1. V. Vijayendra, Introduction to Integrated Electronics: Digital and Analog, First Edition, S. Viswanathan (Printers & Publishers) Pvt., Ltd(2009).
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-Graw Hill, New York (2010).
3. B.L. Theraja, Basic Electronics - Solid State, First Edition, S. Chand and Company Limited, New Delhi(2005).

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 and learn the fundamental concepts of digital electronics.	K1
CO 2	Understand the simplification of logic circuits using Karnaugh mapping and Quine Mc Cluskey method.	K2
CO 3	Apply the concepts of flip flops, registers, analog / digital converters in Data transmission and data storage systems.	K3
CO 4	analyze the importance of combinational and sequential circuits.	K4
CO 5	construct logic circuits using the simplification of boolean equations for the digital networking.	K5
CO 6	design asynchronous and synchronous counters using decoding gates and excitation table.	K6

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
CO 5	H	H	M	M	H	H	H	H	H
CO 6	M	H	H	H	H	H	H	H	H

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
CO 5	H	H	M
CO 6	M	H	H

(For Candidates admitted in the Academic year 2021-2022)

Course Title	MAJOR ELECTIVE 4: COMMUNICATION PHYSICS
Code	U21PH5MET07
Course Type	Theory
Semester	V
Hours/Week	4
Credits	3
Marks	100

CONCEPECTUS

To understand the basic ideas of Radio, Microwave, Satellite, Fiber optic and digital communication systems.

COURSE OBJECTIVES

1. To understand the concepts of modulation, transmission and detection in radio communication systems.
2. To understand and analyze the microwave communication especially the working of television and RADAR.
3. To analyze and apply the concepts and principles of satellite communication Systems
4. To understand optical fiber transmission link, fiber modes configurations and structures in fiber optic communication
5. To understand the concept of digital communication system and to analyze digital modulation techniques and digital transmission media

UNIT I: RADIO COMMUNICATION SYSTEM 12 Hrs

Modulation - Types of modulation - Analysis of amplitude modulated wave - carrier suppression -SSB transmission - advantages and disadvantages - generation of SSB signals - Filter method - FM modulation - FM station - Diode detector - receiver - super heterodyne receiver.

Extra reading / Key words: *Radio, Wireless communication*

UNIT II: MICROWAVE COMMUNICATION 12 Hrs

Introduction - Generation of microwaves - Klystron oscillator - Television picture tube - image orthicon - scanning - synchronization - T.V. Transmission - T.V. reception - Principle of a colour TV - PAL colour receiver - Television screens - CRT and LCD - fundamentals of RADAR - RADAR equation - Automatic Tracking RADAR - Applications of RADAR.

Extra reading / Key words: *Remote monitoring, Microwave towers*

UNIT III: SATELLITE COMMUNICATION 15 Hrs

Introduction - Kepler's I, II, III laws - orbits -satellite launching - station keeping - satellite attitude - power systems - transmission path - path loss - Satellite earth station - satellite station – satellite navigational system- GSM- GPS- DTH- Indian satellites.

Extra reading / Key words: *Mangalyan, Artificial satellite*

UNIT IV: FIBER OPTIC COMMUNICATION 12Hrs

Optical fiber - advantages - Total internal reflection - propagation of light waves in optical fiber - acceptance angle - numerical aperture –Types of fibers - basics of fiber optic system- light sources for fiber optics - LASER diode - light detectors - avalanche photo diode - losses in fiber
-Applications in telecommunication.

Extra reading / Key words: *Submarine cables, splicing*

UNIT V: DIGITAL COMMUNICATION SYSTEMS 12 Hrs

Introduction- Layered view of digital communication- Pulse Amplitude Modulation - Pulse Width Modulation - Pulse Position Modulation - Time Division Multiplexing - Frequency Division Multiplexing - Wireless communication systems - Cell phone - Internet - GPRS - Bluetooth.

Extra reading / Key words*: Digital interface, Communication sources*

TEXT BOOKS:

1. Ambrose A and Vincent Devaraj. T, Introduction to Electronics, 5th Edition, GaungalMera (1992).
2. Dennis Roddy and John Coolen , Electronic Communication , 3rd Edition, Prentice Hall of India. (1995).
3. Robert J. Schoenbeck, Electronic communications, 2nd Edition, Prentice Hall of India Private

Limited, New Delhi (1999).

SUGGESTED READINGS

1. Deshpande N.D.,Deshpande D. A., and Rangole P.K., Communication Electronics, Fifteenth reprint, Tata McGraw Hill Publishing Company Limited, New Delhi (2001).
2. Kennedy, Electronic Communication systems, 4th Edition, Tata McGraw Hill publishing co., Ltd., New Delhi (2002).
3. Kumar R., Communication systems, Anuradha agencies, Educational publishers, Kumbakonam (2000).

WEB REFERENCE

1. https://www.britannica.com/technology/television-technology/Direct-broadcast-satellite-television
2. https://www.britannica.com/technology/radio-technology
3. https://www.tutorialspoint.com/principles_of_communication/principles_of_optical_fiber_communications.htm

COURSE OUTCOMES:

The Learner will be able to :

CO No.	Course Outcomes	Cognitive Level
CO 1	recall the concepts of modulation, transmission and detection in communication systems.	K1
CO 2	understand the basic principles involved in the various communication systems.	K2
CO 3	apply the principles of communication systems to study RADAR, GSM, Television, GPRS, Internet and Bluetooth.	K3
CO 4	analyze digital modulation techniques used in digital transmission media.	K4
CO 5	estimate the parameters such as acceptance angle, numerical aperture used in fibre optic communication systems.	K5
CO 6	develop real time communication systems using digital modulation techniques and fibre mode configuration.	K6

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	M	H	H
CO4	H	H	M	M	L	M	M	H	H
CO5	H	H	M	M	L	M	M	H	H
CO6	H	H	M	M	L	M	M	H	H

PSO – CO MAPPING

	PSO1	PSO2	PSO3
CO1	M	H	M
CO2	M	H	M
CO3	M	H	H
CO4	M	H	H
CO5	M	H	H
CO6	M	H	H

(For Candidates admitted in the Academic year 2021-2022)

Course Title	MAJOR ELECTIVE 4: MICROPROCESSOR INTEL 8085
Code	U21PH5MET08
Course Type	Theory
Semester	V
Hours/Week	4
Credits	3
Marks	100

CONCEPECTUS

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 understand the various parts of microprocessor in Architecture of INTEL 8085
2. To understand the instruction set of INTEL 8085
3. To understand, apply and write simple programs for basic arithmetic and logical operations using the instruction set of INTEL 8085in Programming of Microprocessor
4. To analyze the interfacing techniques involved in INTEL 8085
5. To understand the applications of INTEL 8085 such as digital display, traffic control and generation of square wave

UNIT I: ARCHITECTURE **12 Hrs**

General architecture of microcomputer- Architecture of Intel 8085 – functions of individual blocks – registers in 8085 – pin configuration – functions of individual pins – opcode and operand – instruction cycle – fetch operation – execute operation – machine cycle and state – instruction and data flow.

Extra reading / Key words: *Timing diagram*

UNIT II: INSTRUCTION SET **12 Hrs**

Instruction word size - instruction and data formats – addressing modes– – Data transfer group – arithmetic group – logical group – branch control group – stack, I/O and machine control group.

Extra reading / Key words: *Control instructions*

UNIT III: PROGRAMMING **12 Hrs**

Assembly language - subroutine - addition, subtraction of 8 bit numbers - sum of a series of eight bit numbers – finding smallest/largest element of an integer array- sorting integers in ascending and descending order – complementing- shifting- masking.

Extra reading / Key words: *Program to subtract two 16-bit numbers, Program to alter the contents of flag register*

UNIT IV: INTERFACING TECHNIQUES **12 Hrs**

Address space partitioning – memory and I/O interfacing – data transfer scheme – interrupts of Intel 8085 – programmable peripheral interface –Architecture of Intel 8255 – operating modes – control word.

Extra reading / Key words: *I/O ports,*

UNIT V: APPLICATIONS **12 Hrs**

Delay subroutine using one register, two registers, register pair - 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 – generation of square wave using I / O port - generation of square wave using SOD line

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

TEXT BOOKS

1. Ram B. Fundamentals of microprocessors and microcomputer – Eighth Edition, Dhanapat Rai Publications (P) Ltd, New Delhi (2013).
2. Ramesh Gaonkar, Microprocessor: Architecture, Programming and Applications with 8085, Sixth Edition, Penram International Publishing (India) Pvt.*Ltd*. Mumbai (2013).

SUGGESTED READINGS

1. NagoorKani A., 8085 Microprocessor and its Applications, Third Edition Mcgraw-hill Publications, Chennai (2017).
2. Dr. D.K.Kaushik. An Introduction to Microprocessor 8085. Dhanapat Rai Publishing Company. (2010)
3. Vilas Ghodki , Satish Sharma. Fundamentals of Microprocessor 8085: Programming techniques for microprocessor. LAP LAMBERT Academic Publishing 2012.

WEB REFERENCE

1.https://archive.nptel.ac.in/content/storage2/courses/106108100/pdf/Lecture_Notes/LNm1.pdf

2. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SEC1310.pdf

3. https://www.vssut.ac.in/lecture_notes/lecture1423813120.pdf

4.https://www.engineersinstitute.com/jtolice/microprocessors_jto_lice_study_material_sample.pdf

COURSE OUTCOMES:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO 1	recall the architecture of microcomputers.	K1
CO 2	explain the architecture, pin configuration of INTEL 8085, addressing modes, word size of instructions, operating modes of INTEL 8255 and importance of delay subroutines.	K2
CO 3	apply the instructions of different addressing modes and different word size to write the programs.	K3
CO 4	analyse the interfacing techniques to understand different applications	K4
CO 5	compare different types of programs to justify the statements based on the usage, evaluate the time needed for different delays and criticize the data transfer schemes	K5
CO 6	develop the assembly language programs needed for real life problems.	K6

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	M	H	H
CO4	H	H	M	M	L	M	M	H	H
CO5	H	H	M	M	L	M	M	H	H
CO6	H	H	M	M	L	M	M	H	H

PSO – CO MAPPING

	PSO1	PSO2	PSO3
CO1	M	H	M
CO2	M	H	M
CO3	M	H	H
CO4	M	H	H
CO5	M	H	H
CO6	M	H	H

(For Candidates admitted in the Academic year 2021-2022)

Course Title	NON MAJOR ELECTIVE 3:PHYSICS OF PHOTOGRAPHY
Code	U21PH5NMT03
Course Type	Theory
Semester	V
Hours/Week	3
Credits	3
Marks	100

CONSPECTUS

To understand the basics of light, types of lenses and how to get your camera/ smart phone to catch what your eye sees to produce better pictures.

COURSE OBJECTIVES:

1. To understand the basics of light, lenses and image formation by different lenses
2. To learn the basic working and features of DSLR camera
3. To apply the tricks in cameras to take flawless pictures.
4. To take high-quality, amazing shots using iPhones or Android devices
5. To create themed photos and to make their own photography project book.

UNIT I: LIGHT ANDLENSES **9 Hrs**

Light- Sources- Reflection, Refraction, Dispersion-Lenses-Types of Lenses-Formation of Image by different Lenses-Lens Formula, Magnification and Power of Lens.

Extra Reading/Key words: *Interference, Mirrors*

UNIT II: DSLR PHOTOGRAPHY **9 Hrs**

Camera working- Exposure triangle-Aperture-shutter speed-Depth of field-white balance-Color-contrast- Resolution-Pixels- Digital camera modes-Composing better images.

Extra Reading/Key words : *Types of DSLR cameras, Manual mode Photography*

UNIT III: TIPS ANDTRICKS FOR BETTER PHOTOGRAPH **9 Hrs**

Types of Camera Lenses- usage of different camera lenses-importance of lightning in Photography- Basic photography mistakes – blurry photos.

Extra Reading/Key words : *Reflectors, Types of lighting in photography*

UNIT IV: SMART PHONE PHOTOGRAPHY **9 Hrs**

The World of Smart phone Photography-Lenses and Accessories-Composition-Motion & Depth-Landscape Photography-Portrait Photography- Low Light and Night time- Apps and Editing basics.

Extra Reading/Key words: *Photoshop, Photocomposition*

UNIT V: PHOTOGRAPHY-HANDS ON TRAINING **9 Hrs**

Extra ordinary photos from ordinary subjects- Nature photography-Night light photograph-Create a Photography Project Book.

Extra Reading/Key words: *Black and white photographs, Photo album making*

REFERENCEBOOK:

Course material prepared by the staff members.

WEBREFERENCE:

1. https://photographycourse.net/beginner-photography/
2. https://www.shawacademy.com/courses/photography/learn-smartphone-photography-online/

COURSE OUTCOMES:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO 1	recall the basic concepts of light and its properties.	K1
CO 2	understand working and various features of DSLR camera.	K2
CO 3	apply the different types of lenses to study the formation of images.	K3
CO 4	compare the working of SLR and DSLR cameras.	K4
CO 5	develop smartphone photography editing skills.	K5
CO 6	create perfect photographs and photo books.	K6

PO – CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	H	M	H	H	H	H	M	H
CO 2	H	H	H	H	M	H	H	H	H
CO 3	H	M	H	H	H	H	H	H	H
CO 4	H	H	M	H	H	M	H	H	H
CO 5	H	H	H	H	H	H	H	M	H
CO 6	H	H	H	H	H	M	H	M	H

PSO – CO MAPPING

	PSO1	PSO2	PSO3
CO 1	M	H	H
CO 2	H	H	H
CO 3	H	M	H
CO 4	H	H	H
CO 5	H	M	H
CO 6	H	H	M

(For Candidates admitted in the Academic year 2021-2022)

Course Title	MAJOR SKILL BASED ELECTIVE II: PROBLEM SOLVING SKILLS
Code	U21PH5SBT02
Course Type	Theory
Semester	V
Hours/Week	2
Credits	1
Marks	100

CONSPECTUS: To solve the problems by applying the basic physics principles.

COURSE OBJECTIVES:

1. To solve the problems related to mechanics.
2. To apply the principles of oscillations and optics to solve the problems.
3. To solve the problems related to electricity and magnetism.
4. To apply the principles of heat and thermodynamics to solve the problems.
5. To solve the problems related to solid state physics.

UNIT I: MECHANICS **6 Hrs**

Newton's laws of motion, Kepler's laws, Gravitational Law and field, Conservative and non-conservative forces. Conservation of linear and angular momentum, conservation of energy.

Extra Readings/key words: *Centre of mass, Rigid body motion*

UNIT II: OSCILLATIONS AND OPTICS **6 Hrs**

Simple harmonic oscillator damped and forced oscillators, resonance. Interference of light, diffraction and resolving power, Polarization.

Extra Readings/Key words: *Lissajous figures, optical rotation*

UNIT III: ELECTRICITY AND MAGNETISM **6 Hrs**

Coulomb's law, Gauss's law, Biot-Savart law. Electric field and potential, Conductors, capacitors. Faraday's law of electromagnetic induction, Self and mutual inductance.

Extra Readings/Key words: *Motion of charged particles in electric, magnetic fields*

UNIT IV: KINETIC THEORY **6 Hrs**

Elements of Kinetic theory of gases. Specific heat of Mono-, di- and tri-atomic gases. Ideal gas, van-der-Waals gas, and equation of state.

Extra Readings/Key words: *Mean free path, specific heat at low temperature*

UNIT V: THERMODYNAMICS **6 Hrs**

Zeroth law and the concept of thermal equilibrium. First law and its consequences. Isothermal and adiabatic processes. Second law and entropy. Carnot cycle.

Extra Readings/ Key words: *Phase transitions, Clausius- Clapeyron equation*

SUGGESTED READINGS

1. Robert Resnick, Jearl Walker & David Halliday, Fundamental Of Physics, 10th Edition, John Wiley & Sons (2013).
2. Arthur Beiser, ShobhitMahajan& S. RaiChoudhury, Concepts of Modern physics, 7th Edition, McGraw Hill , New Delhi (2017).
3. M . N. Avadhanulu, Problems in Physics, S. Chand and Company Ltd, New Delhi (2010).
4. H. C. Verma, Concepts of Physics, BharatiBhawan, New Delhi (2021).
5. D. S. Mathur, Mechanics, S. Chand, New Delhi (2000).
6. David J. Griffiths, Introduction to Electrodynamics, Pearson Education Pvt. Ltd., (2015).
7. F. Reif , Fundamentals of Statistical Mechanics and Thermal Physics, Mcgraw-Hill Publishing, New Delhi (2013).

WEB REFERENCE

1. https://careerendeavour.in/iit-jam-physics-study-material/
2. https://jam.iitr.ac.in/jam2022_QPs_AKs.html
3. https://www.physicsbyfiziks.com/freedownload/previous-solution/

COURSE OUTCOMES:

The Leaner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO 1	recall the concepts and basic principles of mechanics and oscillations.	K1
CO 2	understand the formula to solve the problem related to mechanics.	K2
CO 3	apply the oscillation and optics concepts to physical problems.	K3
CO 4	simplify the problems related to mechanics.	K4
CO 5	analyze the thermodynamic problems.	K5

PO – CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	H	H	H	M	H	H	H	H
CO 2	H	H	H	H	H	H	M	H	H
CO 3	H	H	M	H	H	H	H	H	H
CO 4	H	H	H	H	M	H	H	H	H
CO 5	H	H	H	M	H	H	H	M	H
CO 6	H	H	H	H	H	H	H	M	H

PSO – CO MAPPING

	PSO1	PSO2	PSO3
CO 1	H	H	H
CO 2	H	H	M
CO 3	H	M	H
CO 4	H	H	M
CO 5	H	M	H
CO 6	H	H	M

(For Candidates admitted in the Academic year 2021-2022)

Course Title	MAJOR CORE 12: MATHEMATICAL PHYSICS
Code	U21PH6MCT12
Course Type	Theory
Semester	VI
Hours/Week	5
Credits	5
Marks	100

CONSPECTUS

To apply the mathematical concepts of vector calculus, matrix theory, beta, gamma and error functions, Fourier series and probability to solve physical problems.

COURSE OBJECTIVES:

1. To remember the basics of vector algebra and types of matrices
2. To understand the properties of beta, gamma and error functions
3. To apply the Fourier series in real time applications.
4. To apply the probability concepts to solve physical problems.

UNIT I: VECTOR CALCULUS **15 Hrs.**

Gradient of a scalar field – Divergence of a vector function – Curl of a vector function – Line Integral– Surface Integral– Volume Integral – Gauss divergence theorem and its physical significance – Stoke's Theorem and its physical significance.

Extra reading / Key words: *Vector Algebra, Green's Theorem*

UNIT II: MATRIX THEORY **15 Hrs.**

Symmetric and Antisymmetric Matrices, Hermitian and Skew-Hermitian Matrices – Invertible Matrices –Orthogonal and Unitary Matrices – Trace of a Matrix – Rank of a Matrix –Eigen Values, Eigen Vectors: Characteristic Equation of a Matrix – Cayley - Hamilton theorem –Diagonalization of matrices.

Extra reading / Key words*: Power of Matrix, Exponential of a matrix*

UNIT III: BETA, GAMMA AND ERROR FUNCTIONS 15 Hrs.

Definitions of Beta, Gamma and Error functions – Symmetry Property of Beta Function – Evaluation of Beta Function – Transformation of Beta Function – Fundamental property of Gamma function – Evaluation of Gamma Function – Different forms of Gamma Function – Relation between Beta and Gamma functions – Reduction of definite integrals to Gamma function – Evaluation of Miscellaneous Integrals – Evaluation of Error function.

Extra reading / Key words: *Eulerian Integrals, Factorial Function*

UNIT IV: FOURIER SERIES 15 Hrs.

Fourier series – Evaluation of coefficients of Fourier series – Even and odd functions – Dirichlet's theorem and Dirichlet's conditions – Half range series in interval 0 to π – Change of interval from $(-\pi, \pi)$ to $(-l, l)$ – Fourier series in the interval $(0, T)$ – Change of interval from $(0, T)$ to $(0, 2l)$ – Physical examples of Fourier series: Half wave rectifier, Full wave rectifier and Triangular wave.

Extra reading / Key words: *Saw tooth wave, Square wave*

UNIT V: PROBABILITY 15 Hrs.

Binomial Theorem of Probability – Mutinomial Theorem of Probability – Measure of Central Tendency, Averages – Measures of Dispersion or Variation – Karl Pearson's Correlation Coefficient – Standard deviation: Sum of Distribution – Moments – Mathematical Expectation– Moments in terms of Expected Values –Expectation of sum of Stochastic Variates –Expectation of a product of Independent Stochastic Variates.

Extra reading / Key words: *Poisson's Distribution, Normal Distribution*

TEXT BOOKS

1. Gupta.B. D, Mathematical Physics, Vikas Publishing House Pvt. Limited (2006)
2. Joshi.A. W, Matrices and Tensors in Physics, 3rd Edition, New Age International Publishers, (2005).

SUGGESTED READINGS

1. Dass.H. K., Mathematical Physics, S. Chand & Co (2003).
2. Sathya Prakash, Mathematical Physics. Sultan Chand & Sons, Educational Publishers, Sixth RevisedEdition, New Delhi (2012).
3. Rajput. R.S, Mathematical Physics, 12thEdition, Pragati Prakashan Educational Publisher, Meerut(2008).

WEB REFERENCES

1. https://www.whitman.edu/mathematics/calculus_online/section16.01.html
2. https://archive.nptel.ac.in/courses/111/108/111108157/
3. https://www.vedantu.com/maths/beta-function
4. https://mathworld.wolfram.com/FourierSeries.html
5. https://byjus.com/maths/binomial-distribution/

COURSE OUTCOMES:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO 1	recall the fundamentals of vector calculus, types of matrices and statistical methods.	K1
CO 2	explain the physical interpretations of divergence and curl and compare Beta and Gamma functions.	K2
CO 3	apply the principles of vectors, Fourier series and probability theories in real time problems.	K3
CO 4	analyze the problems related to vector calculus, special functions, Fourier series and probability.	K4
CO 5	evaluate different integrals by applying Gamma and Beta functions, and estimate the expected values related to real time applications.	K5

PO - CO MAPPING

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

PSO – CO MAPPING

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

(For Candidates admitted in the Academic year 2021-2022)

Course Title	MAJOR CORE 13: SOLID STATE PHYSICS
Code	U21PH6MCT13
Course Type	Theory
Semester	VI
Hrs/Week	4
Credits	4
Marks	100

CONSPECTUS

To understand the basic ideas of crystallography, nanomaterial, conductors dielectric materials, magnetic materials and superconductors.

COURSE OBJECTIVES:

1. To remember the basics of crystalline solids
2. To understand the classical and quantum theories of conductors
3. To understand the fundamentals of dielectric and magnetic materials.
4. To analyze the properties of superconductors in real time applications.

UNIT - I: CRYSTALLOGRAPHY AND NANOMATERIALS 12 Hrs.

Crystal structure – crystal lattice – basis – unit cell – Bravais lattice – Miller indices – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC and FCC structures – Bragg's law – Atomic scattering factor – X-ray study of crystal structure: Laue method – Powder crystal method.

Nanomaterials – Properties of nanomaterials – Synthesis of nanomaterials: Chemical vapour deposition,electro deposition and ball milling methods (quantitative treatment) –
Applications of CNT's.

Extra reading / Key words: *Structure factor, Reciprocal lattice, Brillouin zone*

UNIT - II: CONDUCTORS 12 Hrs.

Conductors – Classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann- Franz law – Draw backs of classical theory – Specific heat capacity of solids: Einstein's theory and Debye's theoryof specific heat capacity of solids - Quantum theory –

Fermi distribution function – Fermi energy- Effect of temperature on Fermi Function.

Extra reading / Key words: *Fermi level, thermal conductivity*

UNIT - III: DIELECTRIC MATERIALS 12 Hrs.

Definitions – electric polarization, polarization vector, electric displacement vector – dielectric constant and electric susceptibility – types of polarization – effect of frequency and temperature on polarization – Dielectric loss – local or internal field – Clausius – Mosotti equation – Spontaneous Polarization – Ferroelectricity – electrets(qualitative study only).

Extra reading / Key words: *Polarizability, Piezoelectricity*

UNIT - IV: MAGNETIC MATERIALS 12 Hrs.

Definitions – magnetic dipole – magnetic flux density – magnetic permeability – magnetic field strength – magnetic susceptibility –Types of magnetic materials – Classical Langevin Theory of diamagnetic and Paramagnetic Domains – Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains - Discussion of B-H Curve - Hysteresis and Energy Loss.

Extra reading / Key words: *Giant magnetoresistance, Magnetic resonance*

UNIT - V: SUPERCONDUCTORS 12 Hrs.

Superconductors – Properties: Critical Temperature, Critical magnetic field, Persistent current, Meissner effect and Isotope effect - Type I and type II Superconductors (qualitative study only) - BCS theory: Cooper Pair - Coherence length – London's I & II equations – Applications of superconductors.

Extra reading / Key words: *Thermal stability of superconducting wires, Magnetic energy storage*

TEXT BOOKS

1. M. A. Wahab, Solid State Physics: Structure and Properties of Materials, 3rd Edition, Narosa PublishingHouse Pvt. Ltd., New Delhi (2015).
2. S. O. Pillai, Solid State Physics, 10th Multi Colour Edition, New Age International Pvt. Ltd., New Delhi(2023).
3. Saexena, Gupta Saexena, Fundamentals of Solid State Physics, 29th edition, Pragati Prakashan Meerut,(2017).
4. Arumugam M., Materials Science, Anuradha Publishers (2010).
5. M. Willson, K. K. M. Smith and B. Raguse, Nanotechnology: Basic Science and Emerging Technology,1st Edition, CRC Press (2002).

SUGGESTED READINGS

1. Charles Kittel, Introduction to Solid State Physics, , 8th Edition, Wiley India Pvt. Ltd., USA (2005).
2. F. C. Phillips, Introduction to Crystallography, Horney Press, United Kingdom (2011).
3. J.P. Srivastava, Elements of Solid State Physics, 4th Revised Edition, Prentice Hall India Learning PrivateLimited, New Delhi (2015).
4. M. Ali Omar, Elementary Solid State Physics: Principles and Applications, 4th Edition, Addison-Wesley;(1994).
5. I. Timp, Gregory L., Nanotechnology, AIP Press, Springer-Verlag, New York (1999).

WEB REFERENCES

1. https://archive.nptel.ac.in/courses/115/105/115105099/
2. https://web.pdx.edu/~egertonr/ph311-12/solstate.htm
3. https://byjus.com/physics/solid-state-physics/

COURSE OUTCOMES:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive level
CO 1	recall the basics of crystalline solids and nano materials	K1
CO 2	explain the classical and quantum theories of conductors	K2
CO 3	apply the mechanisms of polarization to determine the dielectric characteristics of materials	K3
CO 4	analyze the properties of superconductors in real time applications	K4
CO 5	evaluate the parameters of different materials	K5

PO - CO MAPPING

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

PSO – CO MAPPING

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

(For Candidates admitted in the Academic year 2021-2022)

Course Title	MAJOR CORE 14: SPECTROSCOPY
Code	U21PH6MCT14
Course Type	Theory
Semester	VI
Hours/Week	4
Credits	4
Marks	100

CONSPECTUS:

To make the students to understand the basics of Microwave spectroscopy, Raman, UV-Visible NMR and Mass spectroscopy and to predict the structure of the organic molecules using spectral data

COURSE OBJECTIVES:

1. To remember the interaction of electromagnetic radiations with matter
2. To understand the rotational and vibrational energy of diatomic and polyatomic molecules
3. To understand the electronic and Raman spectra of molecules
4. To understand the theory of NMR and mass spectroscopy.
5. To apply the spectroscopic techniques to study the structure of simple molecules

UNIT I: ROTATIONAL SPECTROSCOPY **12 Hrs.**

Microwave spectroscopy: Rotation of molecules, Rotational spectra of Rigid Diatomic molecule – Intensity of Spectral lines - Spectrum of Non Rigid Rotator - Techniques and Instrumentation- Application of Microwave spectroscopy: Chemical Analysis.

Extra reading/Key words: *Applications of Microwave radiation in synthesis*

UNIT II: INFRARED SPECTROSCOPY **12 Hrs.**

Energy of a vibrating diatomic molecule - the simple harmonic oscillator- The anharmonic oscillator – fundamental absorption, overtones and hot bands, calculation of oscillation frequency and anharmonicity constant – Experimental techniques of IR spectroscopy **Extra reading/Key words*:*** *factors influencing group frequencies*

UNIT III: RAMAN SPECTROSCOPY **12 Hrs.**

Rayleigh Scattering - Occurrence of Raman lines - stokes and antistokes lines - classical theory of Raman effect Polarizability - Quantum theory of Raman effect – Pure Rotational Raman spectra of linear molecule - Experimental Techniques of Raman Spectroscopy

Extra reading/Key words: *Interpretation of functional groups*

UNIT IV: NMR AND MASS SPECTROSCOPY **12 Hrs.**

NMR spectroscopy: Principle of nuclear magnetic resonance - chemical shift - NMR spectrometer- Mass spectroscopy: Basic principle- chemical shift – Applications of Mass spectroscopy: the effect of magnetic field.

Extra reading, Key words: *interpretation of structural information of simple organic molecules using NMR and Mass spectral data*

UNIT -V: ELECTRONIC SPECTROSCOPY **12 Hrs.**

UV-Visible spectroscopy – types of electronic transitions – Electronic spectra in emission and absorption - Electronic spectra of diatomic molecules – vibrational course structure - Intensity of vibrational electronic spectra - Franck–Condon principle - Dissociation energy **Extra reading/Key words:** *factors affecting UV bands and g-value*

TEXT BOOKS

1. Colin Bannwell N and Elaine McCash M, '*Fundamentals of molecular spectroscopy'*, 4th Edition, McGraw hill Publishing company limited, 1994.
2. Y R Sharma, '*Elementary Organic Spectroscopy'*, (5th Revised Edition) S. Chand & Company Pvt. Ltd, 2013.
3. Silver Stein, M.R. and Webster, F.X*., 'Spectral Identification of Organic compounds'* 6th Edition. John Willy& Sons, Inc. NY, 1998.

SUGGESTED READINGS

1. Russell S. Drago, *'Physical methods for chemists'*, Saunders, 1992.
2. Manas Chanda, '*Atomic structure and Chemical Bond Including Molecular Spectroscopy'*, Tata McGraw-Hill Publishing Company Ltd, 1972.
3. McHale, J.L '*Molecular spectroscopy'*, Prentice Hall Publishers**,** 1999.
4. Sindhu, P.S '*Fundamentals of Molecular spectroscopy*' 1st Edition, New Age International publishers, 2006.
5. William Kemp '*Organic Spectroscopy*', 3rd Edition, ELBS publishers, 1991.
6. Russell S. Drago, '*Physical methods in Inorganic Chemistry'*, East West student Edition, 1978.
7. Manas Chanda, '*Atomic structure and Chemical Bond Including Molecular Spectroscopy'*, Tata McGraw-Hill Publishing Company Ltd, 1972.
8. Levine, I.N '*Molecular spectroscopy*', John Wiley and Sons, 2000.

COURSE OUTCOMES:

The learners will be able to

CO's	CO Description	Cognitive Level
CO1	recall the interaction of electromagnetic radiations with matter	**K1**
CO2	explain the electronic and Raman spectra of molecules	**K2**
CO3	apply the spectroscopic techniques to study the structure of simple molecules	**K3**
CO4	relate the vibrational spectra of harmonic and anharmonic oscillators	**K4**
CO5	evaluate the elemental composition using spectroscopic techniques	**K5**

PO – CO MAPPING

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

PSO – CO MAPPING

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

(For Candidates admitted in the Academic year 2021-2022)

Course Title	MAJOR CORE 15: NUCLEAR AND PARTICLE PHYSICS
Code	U21PH6MCT15
Course Type	Theory
Semester	VI
Hours/Week	5
Credits	5
Marks	100

CONSPECTUS

To understand the basic properties of nucleus, nuclear reactions, nuclear models, nuclear energy, nuclear decay and classification of elementary particles.

COURSE OBJECTIVES:

1. To remember the properties of nuclei and different nuclear models.
2. To understand the significance of nuclear reactions
3. To understand the classification and properties of elementary particles
4. To evaluate the age of earth and minerals through the phenomenon of radioactivity.

UNIT I: NUCLEUS AND ITS BASIC FEATURES 15 Hrs.

Basic Properties: Atomic Mass Unit and Binding Energy – Deuteron Binding Energy – Nuclear Forces – Nuclear Stability – Mass Defect and Packing Fraction – Nuclear Binding Energy Curve and Stability of Nuclei – Nuclear Radius – Nuclear Spin and Angular Momentum of Nucleus – Nuclear Magnetic Dipole Moment – Electric Quadrupole Moment – Nuclear Electric Quadrupole Moment – Parity – Change of Parity. **Extra reading / Key words:** *Electron Scattering Experiment, Mirror Nuclei Method*

UNIT II: NUCLEAR REACTIONS AND MODELS 15 Hrs.

Nuclear Reactions – Conservation laws in Nuclear Reactions – Q-value of a Nuclear Reaction – Nuclear Reaction Kinematics – Nuclear Reaction Cross Section -Liquid Drop Model – Semi-empirical mass formula – Applications of Semi-empirical mass formula – Inadequacy of liquid drop model – Shell Model – Magic Numbers – Evidences for existence of Magic Numbers.

Extra reading / Key words: *Nuclear Transmutation, Collective Model*

UNIT III: NUCLEAR ENERGY: NUCLEAR FISSION AND FUSION 15 Hrs.

Significance of Nuclear Energy – Nuclear Fission – Distribution of Mass of Fission Products – Energy Released in Fission – Distribution of Energy of Fragments – Nuclear Chain Reaction – Four Factor Formula – Nuclear Reactor – Basic Design of Nuclear Reactor – Nuclear Reactors – Nuclear Fusion – The Plasma – Fusion Reactions in the Plasma – Conditions for Maintained Fusion Reactions – Stellar Energy.

Extra reading / Key words: *Spontaneous Fission, Stellar Burning*

UNIT IV: NUCLEAR DECAY: RADIOACTIVITY 15 Hrs.

Natural Radioactivity – Becquerel Rays – Properties of α, β and γ rays – Range of α- Particles – Geiger-Nuttal Law – Rutherford and Soddy's Theory of Radioactive Disintegration – Mean Life Period of a Radioactive Element – Half-Life Period – Activity or strength of a radio-sample – Soddy's Displacement Law – Law of successive Disintegration and Radioactive Equilibrium – Radioactive Clock: Age of minerals – Radiocarbon Dating: The age of the earth.

Extra reading / Key words: *Radioactive Branching, Radioactive* Series

UNIT V: PARTICLE PHYSICS 15 Hrs.

Classification of Elementary particles – Particles and Anti-particles – Fundamental interactions – Elementary-particle Quantum Numbers (charge, spin, parity, isospin, strangeness, etc.) – Conservation Laws- CPT-theorem – Symmetry Classification of elementary particles – Quark model – Gellmann-Nishijima formula – Coloured quarks and gluons.

Extra reading / Key words: *Quantum Chromodynamics, Grand Unification Theory*

TEXT BOOKS

1. Murugesan, Modern Physics, S. Chand and Company Ltd., Ram Nagar, New Delhi (2008).
2. Subrahmanyam.N and Brijlal, Atomic and Nuclear Physics, S. Chand and Company Ltd., New Delhi (2022), First Edition 1984, Revised Edition 2009, Reprint 2022.
3. Gupta .A.B and Roy H.P., Physics of the Nucleus, Books and Allied (P) Ltd., Revised Reprint, Kolkata (2011).
4. Satya Prakash, Nuclear Physics, Pragati Prakashan Educational Publishers, Fourth Edition, Meerut (2015).

SUGGESTED READINGS

1. Rao .B.V.N., Modern Physics, Wiley Eastern Ltd., New Delhi (1993).
2. Aruldas.G and Rajagopal, Modern Physics, PHI, New Delhi, 2005.
3. Rajam. J.B., Modern Physics, S.Chand & Co. Pvt. Ltd, New Delhi (1983).
4. Tayal. D.C., Nuclear Physics, Himalaya publishing House, (2015).

5. Beiser.A, Concepts of Modern Physics, Tata McGraw-Hill Ltd., New Delhi (2002).
6. Martin B R & Shaw G, Particle Physics, Third Edition, Wiley (2008).

WEB REFERENCES

1. http://hyperphysics.phy-astr.gsu.edu/hbase/NucEne/nucbin.html
2. http://hyperphysics.phy-astr.gsu.edu/hbase/NucEne/fusion.html
3. https://www.britannica.com/science/subatomic-particle/Elementary-particles

COURSE OUTCOMES:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO 1	recall the properties of nucleus and different nuclear models	K1
CO 2	summarize the key features of nuclear fission and fusion and explain the nuclear reaction kinematics.	K2
CO 3	apply the principles of nuclear reactions to understand nuclear energy generation.	K3
CO 4	analyze the properties and behaviours of different elementary particles.	K4
CO 5	estimate the age of earth and minerals through the phenomenon of radioactivity.	K5

PO – CO MAPPING

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

PSO – CO MAPPING

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

(For Candidates admitted in the Academic year 2021-2022)

Course Title	**MAJOR CORE 16: MAIN PRACTICAL IV – ADVANCED DIGITAL AND MICROPROCESSOR PRACTICALS**
Code	**U21PH6MCP16**
Course Type	**Practical**
Semester	**VI**
Hours/Week	**6**
Credits	**4**
Marks	**100**

CONSPECTUS

To understand the basic role of various components in electronic circuits, to build the circuits such as amplifiers and oscillators, to study the basic digital circuits and to do simple programs in microprocessor.

COURSE OBJECTIVES

1. To understand the working of Emitter follower
2. To understand the applications of OP-AMP
3. To apply the instruction of INTEL 8085 to write simple programs
4. To understand the working of combinational and sequential circuits

LIST OF EXPERIMENTS:

1. Construction of Emitter Follower using Transistor.
2. Study of Flip Flops.
3. Study the functions of Shift Registers- Shift Left, Shift Right, Parallel in and Parallel Out
4. Microprocessor INTEL 8085 – Programming to find the Sum of Series of 8 – bit Numbers whose sum is (i) 8-bit (ii) 16-bit.
5. Study of Up, Down and Ring Counters.
6. Construction of Multiplexer Using Logic Gates and Study of IC74153.
7. Construction of De-Multiplexer Using Logic Gates and Study of IC74155.
8. Microprocessor INTEL 8085 – Programming for identifying the biggest and smallest number from a series.
9. Microprocessor INTEL 8085 – Programming for Arranging the numbers in Ascending and descending orders.
10. Interfacing of INTEL 8255 with Microprocessor.
11. Op- Amp Waveform generator – square waveform.

12. Construction of Synchronous counters using excitation table.
13. Construction and study of relaxation oscillator using UJT.
14. V-I Characteristics of Solar Cell.
15. Determination of Planck's constant using LED
16. Microprocessor: Name Display-Static and Rolling

WEB REFERENCES

1. https://www.technicalsymposium.com/microprocessor_lab.pdf
2. https://www.studocu.com/in/document/jain-deemed-to-be-university/data-stuctures-and-algorithms/experiment-6- mux-and-demux/21560014
3. https://www.geeksforgeeks.org/counters-in-digital-logic/

COURSE OUTCOMES:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO 1	recall the working of digital circuits	K1
CO 2	explain the working of sequential and combinational circuits.	K2
CO 3	apply the instructions of INTEL 8085 to execute simple programs	K3
CO 4	analyze the V- I characteristics of solar cell	K4
CO 5	Construct the synchronous and asynchronous counters	K5

(For Candidates admitted in the Academic year 2021-2022)

Course Title	SKILL BASED COURSE 6: RESEARCH METHODOLOGY
Code	U21DS6SBC03
Course Type	Theory cum Project
Semester	VI
Hrs. / Week	2
Credits	1
Marks	100

CONSPECTUS:

Students get introduced to concept of research and to carry out research projects.

COURSE OBJECTIVES

1. To understand the different types of research.
2. To analyze the research objectives and frames the hypothesis.
3. To understand the structure of dissertation.
4. To evaluate their research work.

UNIT I: INTRODUCTION TO RESEARCH **6 Hrs.**

Concept of research–types of research–introduction to research literature base – collection of research information from different sources; maintenance of information.

Extra reading / Key Words: *Primary data, Secondary data collection*

UNIT II: RESEARCH FOCUSING **6 Hrs.**

Identifying research area–drawing objectives\ hypothesis–designing the work – data collection –analysis.

Extra reading / Key Words: *Test of Hypothesis and Levels of significance.*

UNIT III: PREPARATION OF DISSERTATION **6 Hrs.**

Structure of dissertation–editing–bibliography.

Extra reading / Key Words: *Summarizing any Two research article.*

UNIT IV: PROJECT WORK **12 Hrs.**

REFERENCE BOOKS

1. Blaxter, L., Hughes, C. and Tight (1999) How to research? Viva Book private Limited.
2. Kothari, C.R. (2004) research Methodology- Methods and Techniques, New AgeInternational Publishers, India.
3. Lal, B. (2002) Research Methodology, ABD Publishers.

(For Candidates admitted in the Academic year 2021-2022)

Course Title	**NON MAJOR ELECTIVE 4: PHYSICS FOR COMPETITIVE EXAMS**
Code	**U21PH6NMT04**
Course Type	**Theory**
Semester	**VI**
Hrs/Week	**3**
Credits	**3**
Marks	**100**

CONSPECTUS

To understand the basics of General physics and Modern physics and apply the concept to measure the physical quantities.

COURSE OBJECTIVES:

1. To remember the basics of mechanics and properties of matter.
2. To understand the basics of electricity and magnetism.
3. To understand the laws of heat and thermodynamics.
4. To apply the mirror and lens laws to find focal length of the material.
5. To analyze the atomic models and radiation properties.

UNIT I: GENERAL PHYSICS 9 Hrs.

Mechanics - Properties of Matter- Force - Motion - Energy - Power

Extra Reading / Keywords: *Physical Quantities, Standards & Units, Special Relativity*

UNIT II: HEAT AND THERMODYNAMICS 9 Hrs.

Specific heat capacity - Laws of Thermodynamics - Adiabatic process - Transfer of heat – Emissive power - Kirchhoff's Law - Stefan's law - Newton's Law of Cooling.

Extra Reading / Keywords: *Perfect black body*

UNIT III: LIGHT AND SOUND 9 Hrs.

Properties of light - Theories of light - Mirror and Lens - Properties of sound – Reverberation – Doppler Effect.

Extra Readings / Keywords: *Scientific Instruments, Inventions and Discoveries*

UNIT IV: ATOMIC & NUCLEAR PHYSICS 9 Hrs.

Atom models- Spectral series of hydrogen atom - X–rays – production and properties. Properties of nucleus –Radioactivity-Properties of neutrons- Nuclear fission- Nuclear fusion -The Universe.

Extra Reading / Keywords: Cathode rays, Canal rays, *Atomic Bomb,* Quarks.

UNIT V: ELECTRICITY AND MAGNETISM **9 Hrs.**

Electric Potential and Potential Difference- Resistors - Electric Power- Drift velocity and mobility-Current density- Superconductivity-Basic properties of magnets – Classification of magnetic Materials.

Extra Reading / Keywords : *Kirchhoff's law, Faraday's laws of electrolysis, Electromagnetic waves.*

TEXT BOOK

Course material prepared by staff members.

WEB REFERENCES

1. https://www.tnpscnote.com/2020/08/6-to-10-physics-tnpsc-notes.html
2. http://examstudy.maanavan.com/important-notes-in-physics-for-all-tnpsc-exam-in-tamil-pdf-download/
3. https://examsdaily.in/physics-study-materials-important-topics

COURSE OUTCOMES:

The Learner will be able to:

CO No.	Course Outcomes	Cognitive Level
CO-1	recall the basics of mechanics and properties of matter.	**K1**
CO-2	explain the basics of electricity and magnetism.	**K2**
CO-3	apply the mirror and lens laws to find focal length of the material.	**K3**
CO-4	analyze the atomic models and radiation properties.	**K4**