SRI RAMAKRISHNA MISSION VIDYALAYA COLLEGE OF ARTSAND SCIENCE
COIMBATORE - 641 020

B.Sc. PHYSICS

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

The program educational objectives are set in line with Institutional and Departmental mission statements. The program educational objectives of Department of Physics are to produce candidates of good basics knowledge in Physics concepts and who later take the role of researchers with following qualities:

PEO1: Consolidates the knowledge acquired at +2 level and improves the ability to solve the problems in physics

PEO2: Students will have an enhanced proficiency in understanding the physical concepts, principles and theories of Physics and applying it in day-to-day life.

PEO3: Develop the ability to apply the knowledge acquired in the classroom and laboratories to specific problems in theoretical and experimental Physics.

PEO4: Analytical thinking and applying skills to develop initiatives and innovative ideas for R&D, industry and social requirements.

PEO5: Develops the learners' personality to suite current industry environment and entrepreneurial skills

PROGRAMME OUTCOMES

PO1: Provide platforms to learn Physics, Chemistry and Mathematics theories, concepts and practical skills with appropriate knowledge.

PO2: Assimilate the knowledge on understanding the nature and ability to link the facts to observe and discover scientific laws.

PO3: Create new skills and tools to obtain possible solutions in comprehension of the physical science problems incorporating mathematical modeling and theories.

PO4: Enhancement of critical thinking, problem solving skills, digitally efficient and making effective working professionals to suit for science, technical and research field.

PO5: Making best suitable personalities to serve for nation and society with ethical awareness and reasoning ability.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

The graduates able to

PSO1: improve the understanding capabilities in fundamental laws, concepts, principles and theories in the different academic field of Physics and its associated fields. Can understand the basics of computer and data science. Accomplish theoretical and laboratory skills

PSO2: utilize the procedural knowledge acquired in different areas of study in Physics outlined above in research and development, teaching, government and public services.

PSO3: assimilate interest and to the improve competencies of individuals in specialized area relating to the subfields and current developments in Physics.

PSO4: apply theoretical and laboratory skills to new/unfamiliar contexts to identify problems and issues relating to Physics. Skill enhancement in analysis and formulation of new theories and concepts.

PSO5: develop communication abilities to present their findings and results in technical and popular science forums organized in various universities and other private organizations.

SRI RAMAKRISHNA MISSION VIDYALAYA COLLEGE OF ARTSAND SCIENCE
(AUTONOMOUS)
COIMBATORE - 641 020.
B.Sc. Physics
Under Choice Based Credit System (CBCS) 2020-21 Onwards
SCHEME OF EXAMINATION

SEMESTER-I									
S.No.	**Course Code**	**Part**	**Course Title**	**Hrs. / wk.**	**Credits**	**Exam Hrs.**	**Max. Marks**		
							Int.	**Ext.**	**Total**
1	20UGC1TA1/1HI1	I	Tamil – I Amutha Tamil / Hindi – I	6	3	3	50	50	100
2	20UGC1EN1	II	English - I	6	3	3	50	50	100
3	20UPH1C01	III	Core -1 Properties of Matter and Sound	5	5	3	50	50	100
4	20UPH1C02	III	Core - 2 Kinematics, Waves and Oscillations	2	2	2	50	--	50
5	20UPH1AL1	III	Allied 1: Allied Mathematics - I	6	5	3	50	50	100
6	20UPH2CP1	III	Core Practical - 1 General Experiments - I[@]	3	--	--	--	--	--
7	20UPH2CP2	III	Core Practical - 2 Electronics Experiments[@]	2	--	--	--	--	--
			SUB TOTAL - I	**30**	**18**	**--**	**--**	**--**	**450**

SEMESTER-II									
S.No.	**Course Code**	**Part**	**Course Title**	**Hrs. / wk.**	**Credits**	**Exam Hrs.**	**Max. Marks**		
							Int.	**Ext.**	**Total**
1	20UGC2TA2/ 2HI2	I	Tamil – II Kappiya Tamil / Hindi - II	6	3	3	50	50	100
2	20UGC2EN2	II	English - II	6	3	3	50	50	100
3	20UPH2C03	III	Core-3 Electricity and Magnetism	5	5	3	50	50	100
4	20UPH2C04	III	Core-4 Dynamics of Fluids and Rigid bodies	2	2	2	50	--	50
5	20UPH2AL2	III	Allied 2: Allied Mathematics-II	6	5	3	50	50	100
6	20UPH2CP1	III	Core Practical - 1 General Experiments - I	3	3	3	50	50	100
7	20UPH2CP2	III	Core Practical - 2 Electronics Experiments	2	2	3	50	50	100
8	20UGC2ENS	IV	Environmental Studies		2	2	--	50	50
			SUB TOTAL - II	**30**	**25**	**--**	**--**	**--**	**700**

SEMESTER-III									
S. No.	**Course Code**	**Part**	**Course Title**	**Hrs. / wk.**	**Credits**	**Exam Hrs.**	**Max. Marks**		
							Int.	**Ext**	**Total**
1	20UGC3TA3/ 3HI3	I	Tamil – III Deiva Tamil / Hindi - III	6	3	3	50	50	100
2	20UGC3EN3	II	English – III English Grammar and Composition	6	3	3	50	50	100
3	20UPH3C05	III	Core -5 Analog and Digital Circuits	5	5	3	50	50	100
4	20UPH3AL3	III	Allied 3: Allied Chemistry - I	4	4	3	35	35	70
5	20UPH4CP3	III	Core Practical - 3 General Experiments - II@	3	--	--	--	--	--
6	20UPH4CP4	III	Core Practical - 4 Analog and Digital Experiments@	2	--	--	--	--	--
7	20UPH4AP1	III	Allied Chemistry Practical@	2	--	--	--	--	--
8	20UPH3NM1/ 20UGC3TB1	IV	Non-Major Elective (NME)-I Solid State Chemistry-I /Basic Tamil-I	2	2	2	--	50	50
			SUB TOTAL - III	**30**	**17**	**--**	**--**	**--**	**420**

SEMESTER-IV									
S. No.	**Course Code**	**Part**	**COURSE TITLE**	**Hrs/ wk**	**Credits**	**Exam Hrs.**	**Max. Marks**		
							Int.	**Ext**	**Total**
1	20UGC4TA4 / 4HI4	I	Tamil – IV Sanga Tamil / Hindi - IV	6	3	3	50	50	100
2	20UGC4EN4	II	English – IV Immortal Speeches from Shakespeare and Public Speaking	6	3	3	50	50	100
3	20UPH4C06	III	Core - 6 Heat, Thermodynamics and Statistical Mechanics	5	5	3	50	50	100
4	20UPH4AL4	III	Allied 4: Allied Chemistry - II	4	4	3	35	35	70
5	20UPH4CP3	III	Core Practical - 3 General Experiments - II	3	3	3	50	50	100
6	20UPH4CP4	III	Core Practical - 4 Analog and Digital Experiments	2	2	3	50	50	100
7	20UPH4AP1	III	Allied Practical Chemistry	2	2	3	30	30	60
8	*/ 20UGC4TB2	IV	NME -II*/Basic Tamil-II	2	2	2	--	50	50
9	20UGC4VAE	IV	Value Education ***		2	2	--	50	50
10	20UGC4 NCC/NSS/SPO/YRC	V	Extension Activities - NCC/NSS/SPORTS/YRC	--	1	--	25	25	50
			SUB TOTAL - IV	**30**	**27**	**--**	**--**	**--**	**780**

SEMESTER-V									
S. No.	Course Code	Part	Course Title	Hrs/ wk	Credits	Exam Hrs	Max. Marks		
							Int.	Ext	Total
1	20UPH5C07	III	Core - 7 Mathematical Physics and Classical Mechanics	5	5	3	50	50	100
2	20UPH5C08	III	Core - 8 Optics	5	5	3	50	50	100
3	20UPH5C09	III	Core - 9 Atomic Physics and Spectroscopy	5	5	3	50	50	100
4	20UPH5C10	III	Core - 10 Microprocessor and its Physics Applications	5	5	3	50	50	100
5	20UPH5CP5	III	Models based on Concepts of Physics	2	3	--	50	50	100
6	20UPH6CP6	III	Core Practical - 5[@] Advanced Experiments	3	--	--	--	--	--
7	20UPH6CP7	III	Core Practical - 6[@] Microprocessor and C - Programming in Physics	3	--	--	--	--	--
8	20UPH6CPR	III	Project Work[@]	2	--	--	--	--	--
			SUB TOTAL - V	**30**	**23**	**--**	**--**	**--**	**500**

SEMESTER-VI									
S. No.	Course Code	Part	Course Title	Hrs. / wk.	Credits	Exam Hrs.	Max. Marks		
							Int.	Ext.	Total
1	20UPH6C11	III	Core -11 Relativity, Wave Mechanics and Space Physics	5	5	3	50	50	100
2	20UPH6C12	III	Core - 12 Solid State Physics	5	5	3	50	50	100
3	20UPH6C13	III	Core - 13 Nuclear Physics	5	5	3	50	50	100
4	20UPH6C14	III	Core –14 Programming in C and its Physics Applications	5	5	3	50	50	100
5	20UPH6EA1 / 6EB1	III	Elective – I Alternate Energy Resources / Data Science using 'R'	4	4	3	50	50	100
6	20UPH6CP6	III	Core Practical – 5 Advanced Experiments	3	3	3	50	50	100
7	20UPH6CP7	III	Core Practical - 6 Microprocessor and C - Programming in Physics	3	3	3	50	50	100
8	20UPH6CPR	III	Project Work[@]	--	4	--	50	50	100
			SUB TOTAL - VI	**30**	**34**	**-**	**--**	**--**	**800**

@ non-semester practical / project work

List of Non Major Elective (NME): II

Course Code	Course Title
20UCO4NM2	Entrepreneurship Development
20UMA4NM2	Quantitative methods for competitive Examinations
20UCH4NM2	Health Awareness & Management
20UEC4NM2	Maintenance of Domestic Applications
20UEL4NM2	English for Competitive Examination
20UCS4NM2	Web Programming

ALLIED PHYSICS

FOR CHEMISTRY

SEMESTER – III									
S. No.	Course code	Part	Course Title	HRS/ WK	Credits	Exam Hours	Max Marks		
							Int	Ext	Tot
01	20UCH3AL3	III	Allied Physics - I	4	4	3	35	35	70
02	20UCH4AP1	III	Allied Physics Practical	2	-	-	-	-	-
SEMESTER – IV									
01	20UCH4AL4	III	Allied Physics - II	4	4	3	35	35	70
02	20UCH4AP1	III	Allied Physics Practical	2	2	3	30	30	60

FOR MATHEMATICS

SEMESTER – I									
S. No.	Course code	Part	Course Title	HRS/W K	CRE DITS	Exam Hours	Max Marks		
							Int	Ext	Tot
01	20UMA1AL1	III	Allied Physics- I	4	4	3	35	35	70
02	20UMA2AP1	III	Allied Physics Practical	2	-	-	-	-	-
SEMESTER – II									
01	20UMA2AL2	III	Allied Physics-II	4	4	3	35	35	70
02	20UMA2AP1	III	Allied Physics Practical	2	2	3	30	30	60

NON-MAJOR ELECTIVE (NME*)

FOR Chemistry / All Programmes

SEMESTER – III									
S. No.	Course code	Part	Course Title	Hrs/ WK	CREDITS	Exam Hours	Max Marks		
							Int	Ext	Tot
01	20UCH3NM1	IV	Instrumental Methods for Chemical Analysis	2	2	2	--	50	50
SEMESTER – IV									
S. No.	Course code	Part	Course Title	Hrs/WK	Credits	Exam Hours	Max Marks		
							Int	Ext	Tot
01	20UPH4NM2	IV	Energy Auditing	2	2	2	--	50	50

***** Non Major elective I offered by Physics Department to Chemistry Department

@ Non Major elective II offered by Physics Department to other Departments

Total Marks (I+II+III+IV+V+VI)	**3650**
Total credits (I+II+III+IV+V+VI)	**144**

Planned Value added Courses

1. Physics instrumentation skill

2. CCTV installation and mobile servicing

Credits and Marks

	Credit	Marks
Part I	12	400
Part II	12	400
Part III	111	2600
Part IV	8	200
Part V	1	50
Total	**144**	**3650**

Course Title	Core 1: Properties of Matter and Sound	**Course Code**	20UPH1C01
Year	I	**Semester**	I
Hours/week	5	**Credits**	5

COURSE OBJECTIVES

To enable the students to

- know about basic principles of gravitation and elasticity
- understand and apply the laws of surface tension and viscosity of liquids
- know about simple harmonic motion
- impart the concepts of measurements of sound and acoustics.

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	assimilate the concepts of gravitation and elasticity of materials.	K1
CO2	measure the values of surface tension and viscosity of liquids at different temperatures.	K3
CO3	understanding of uses and applications of sound energy its measuring techniques, derive the equation of motion for free, damped and forced oscillations.	K2
CO4	apply the knowledge of reverberation -time, absorption co-efficient calculations in the construction of good auditorium, acoustics of buildings.	K3
CO5	imparting techniques for generation of ultrasonic waves and handling of CRO	K4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	M		S	S	M	L	M
CO2	S	M	M	S	M		M	S	S	S	M
CO3	S	M	S	S	M		S	S	M	S	M
CO4	S	S	M	S	M		S	S	S	S	S
CO5	M	S	M	S	L		S	M	M	S	S

S - Strong; M - Medium; L - Low

UNIT - I: GRAVITATION

Newton's law of gravitation - Kepler's laws - Deduction of Newton's law of gravitation from Kepler's law - Determination of 'G' by Boy's method - Poynting's method - Gravitational field and Gravitational potential -***Determination of gravitational potential and field due to a solid sphere** - Determination of 'g' by compound pendulum and Kater's pendulum.

UNIT - II: ELASTICITY

Relation between the elastic moduli - Poisson's ratio - Determination of Poisson's ratio for rubber - Torsion of a cylinder- Expression for torque per unit twist - Determination of Rigidity modulus - Static torsion method- Dynamic torsion method- Work done in twisting a couple - Torsional oscillations of a body - Bending of Beam- Expression for the bending moment - ***Measurement of Young's modulus- Non-uniform and Uniform bending**.

UNIT - III: SURFACE TENSION AND VISCOSITY

***Surface tension and surface energy**- Pressure difference across a liquid surface -Excess pressure inside a - Liquid drop - Soap bubble - Curved liquid surface- Applications to cylindrical, spherical drops and bubbles - Experimental determination of surface tension: Jaegar's method - drop weight method.

Coefficient of viscosity - Poiseuille's formula for the flow of a liquid through a capillary tube - Poiseuille's method for determination of coefficient of viscosity of a liquid- ***Terminal Viscosity and Stoke's formula**-Stoke's formula for the coefficient of viscosity of viscous liquid.

UNIT - IV: MEASUREMENT OF SOUND AND HARMONIC OSCILLATOR

Classification of Sound- Intensity of sound- Measurement of intensity of sound- ***Doppler effect**- wave front at supersonic speed - ***Simple Harmonic Motion and harmonic oscillator**-Energy of Harmonic oscillator - Free, Damped and Forced vibrations - free vibrations of a body- Equations of damped harmonic oscillations - Equations of Forced oscillations - Resonance.

UNIT - V: ACOUSTICS

Reverberation - Sabine's formula - Determination of absorption coefficient - Factors affecting the acoustics of building and their remedies - Ultrasonic waves - protection and applications - Acoustic grating - Wave velocity and group velocity - Frequency measurements - Study of waves using CRO -***CRO Applications- Lissajous figures**.

Books for study

1. Brijlal and Subramaniam, *Properties of Matter*, Eurasia Publishing House Pvt. Ltd, New Delhi. 3rd Edition, 2002.
2. R. Murugesan, *Properties of Matter*, S. Chand &Company, New Delhi, 5th Edition ,2020.
3. R. Murugesan, *Mechanics and Mathematical Methods*, S. Chand &Company, New Delhi, 3rd Edition ,2014.
4. Subramaniam and Brijlal , *A Text Book of Sound,* Vikas Publishing House Pvt. Ltd. New Delhi, 2nd Edition ,2018.

Book for reference

D.S Mathur, *Elements of Properties of Matter*, S. Chand &Company, New Delhi, Eleventh Edition 2014.

E-Resources

1. http://astrowww.phys.uvic.ca/~tatum/celmechs/celm5.pdf
2. https://www.concepts-of-physics.com/mechanics/stokes-law-and-terminal-velocity.php
3. https://byjus.com/physics/free-forced-damped-oscillations/
4. https://www.electrical4u.com/lissajous-patterns-of-cro/

Course Title	Core 2: Kinematics, Waves and Oscillations	**Course Code**	20UPH1C02
Year	I	**Semester**	I
Hours/week	2	**Credits**	2

COURSE OBJECTIVES

To enable the students

- to understand the kinetics of moving systems and related laws and definitions
- to work with energy related problems of moving bodies using Newton's equation of motion.
- to enhance the knowledge in execution of simple harmonic motion in mechanical systems and its behaviors.

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	Know about the principles of acceleration, velocity, laws of motion, mass, energy, angular velocity to measure some of the physical parameters	K1
CO2	solve the real time problems exist in various scientific and technical areas.	K4
CO3	understand the Newtonian laws, conservation of physical quantities and to face the multiple choice-based examinations.	K2
CO4	comprehend the conservation of momentum and wave motions	K4
CO5	Make measurement on various parameters involved in variety of wave motion	K3

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

MAPPING

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	M		S	S	S	M	M
CO2	M	S	S	S	M		S	S	M	S	L
CO3	S	S	M	M	M		S	S	M	S	M
CO4	S	S	M	M	L		S	S	M	M	S
CO5	M	S	M	M	M		S	S	S	M	M

S - Strong; M - Medium; L - Low

UNIT - I: VERTICAL AND PLANE MOTION

Motion in a straight line, Velocity, Acceleration - Distance, velocity and acceleration - Motion in a vertical plane - acceleration due to gravity - falling bodies -linear momentum - impulse - conservation of linear momentum -collisions-angular measure-angular velocity-conical pendulum- ***problems and multiple-choice questions.**

UNIT- II: NEWTON'S LAW OF MOTION

First law of motion - Mass- second law of motion - weight- Third law of motion- Two and three dimensions - Energy - work - power- Efficiency -Kinetic energy -Potential energy- Rest energy- conservation of energy -***problems and multiple choice questions**

UNIT - III: WAVES AND OSCILLATIONS

Simple harmonic motion- equation of a simple harmonic wave- restoring force- period and frequency-stationary waves - waves and sound wave properties- wave motion - mechanical waves - velocity of wave, amplitude of a wave-wavelength - Transverse and longitudinal waves - speed of sound- ***principle of superposition of waves.**

Book for study

Arthur Beiser, *Applied Physics Schaum's outlines,* Tata McGraw Hill, Company limited, 4th Edition, 2010

Book for reference

S.L. Arora, *New Simplified Physics*, Volume I and II, Publications Dhanpat Rai & Co. 7thEdition 2018.

E-Resources

1. http://ocw.mit.edu/courses/#physics
2. http://hyperphysics.phy-astr.gsu.edu
3. https://www.coursera.org
4. https://nptel.ac.in/courses/115/102/115102014/

Course Title	Core 3: Electricity and Magnetism	**Course Code**	20UPH2C03
Year	I	**Semester**	II
Hours/week	5	**Credits**	5

COURSE OBJECTIVES

- To know about the fundamental concepts of linear circuits and Phenomenon of series and parallel resonance circuits.
- Enable to understand the theorems and applications of electromagnetic and electrostatics induction
- Enhances the ability to determine the magnetic potential in various physical situations.
- Appreciate the properties and theories of various magnetic materials in detail.

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	Construct linear circuits and phenomenon of series and parallel resonance circuits.	K3
CO2	Predicts the motion of charged particles in electric and magnetic fields.	K2
CO3	Explain the basics of capacitors, capacitance of capacitors and role of resistance in electrical circuits.	K1
CO4	Understand various laws and principles related magnetism and magnetic induction	K2
CO5	Classify the magnetic materials and analyze their behaviors using associated theories	K4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	M		S	S	M	S	M
CO2	S	M	M	M	L		S	S	M	S	M
CO3	S	S	M	S	M		S	S	M	S	L
CO4	S	M	M	S	M		S	S	M	M	L
CO5	S	S	M	M	M		S	S	M	M	M

S - Strong; M - Medium; L – Low

UNIT-I: LINEAR CIRCUIT ANALYSIS:

DC Circuits containing L and R, C and R, L,C and R & AC circuit containing C, L, R and R, C and R, L, C - R L C in series and parallel - Phenomenon of Resonance - Series and parallel resonance circuit and Q factor.

NETWORK THEOREMS: Thevenin theorem - Norton theorem - Superposition theorem - Maximum Power Transfer theorem - ***FILTER CIRCUITS: Low pass, High pass, Band pass circuits.**

UNIT-II: ELECTROSTATICS

Gauss's theorem and its applications - Coulomb's law - Mechanical force experienced by unit area of a charged sphere - Electrified soap bubble -***Electrical images (Basics Only).** Capacitors: Capacity of a conductor- Energy of a charged conductor- Sharing of energy between two capacitors - Principle of a capacitor- capacity of a spherical and cylindrical capacitors - ***Capacitors in series and in parallel**.

UNIT- III: MAGNETIC PRINCIPLES AND LAWS

Biot-Savart law - Ampere's circuital law - Lorentz force - Electromagnetic Induction: Faraday's laws - Lenz's law - Fleming's right hand thumb rule - Self-inductance -Self-inductance of a long solenoid - Determination of self-inductance by Rayleigh's method - Mutual inductance - mutual inductance between two solenoids -***Determination of mutual inductance**.

UNIT- IV: MAGNETIC POTENTIAL

Permeability - susceptibility - Relation between μ and χ -Magnetic potential - potential and intensity at a point due to a bar magnet- magnetic intensity at any point due to bar magnet - magnetic potential at a point due to a magnetized sphere - magnetic shell - potential at a point due to a magnetic shell - ***Gauss theorem in magnetism - applications**.

UNIT - V: MAGNETIC MATERIALSAND PROPERTIES

Magnetic induction - Magnetization M - Properties of dia, para and ferro magnetic materials - Antiferro magnetism and ferri magnetism - Electron theory of magnetism -Langevin's theory of para magnetism - Weiss theory of ferromagnetism -***determination of draw M-H curve (horizontal model) - Energy loss due to hysteresis.**

Books for study

1. Sathya Prakash, *Electricity and Magnetism*, Pragathi Prakashan Publications, 32th Edition 2018.
2. Brijlal and Subramaniam, *Electricity and Magnetism*, Ratan Prakashan Mandir, New Delhi, 6th Edition 2000.
3. R. Murugeshan, *Electricity and Magnetism.* S. Chand & Company Publications, New Delhi, 10th Edition 2019.

Book for reference

K.K. Tewari, Electricity and Magnetism, S. Chand & Company Publications, New Delhi, 3rd Edition 2007.

E-Resources

1. http://ocw.mit.edu/courses/#physics
2. http://hyperphysics.phy-astr.gsu.edu
3. https://www.askiitians.com/iit-jee-magnetism/magnetic-properties-of-materials
4. https://www.askiitians.com

5. http://nptel.ac.in/courses/115106090/

Course Title	Core 4: Dynamics of Fluids and Rigid bodies	**Course Code**	20UPH2C04
Year	I	**Semester**	II
Hours/week	2	**Credits**	2

COURSE OBJECTIVES

- To know about the basic concepts of heat, pressure and degree of freedom.
- To understand the Pascal's law, viscosity, flow and Bernoulli's theorem
- To study the circular motion, rigid body, moment of inertia and simple geometrical objects

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	acquire knowledge about theory of gases, interpretations of temperature, degree of freedom and specific heat capacities	K1
CO2	Obtain the degrees of freedom and specific heat capacity values of gaseous molecules	K4
CO3	understand the concept of fluid, Pascal's law, viscosity, flow and Bernoulli's theorem	K2
CO4	Comprehend the essentials of rigid body dynamics and the physical parameters involved	K2
CO5	explain the motion of the vehicles on differently elevated roads and to solve the problems occur in motion,	K3

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	L		M	M	S	S	L
CO2	S	M	M	S	L		S	M	S	M	L
CO3	S	S	M	M	M		S	S	M	M	L
CO4	S	S	M	M	M		S	S	M	M	L
CO5	M	S	S	M	L		S	S	M	S	M

S - Strong; M - Medium; L - Low

UNIT -I: KINETIC THEORY OF GASES

Kinetic theory of gases - assumptions, concept of pressure - kinetic interpretation of temperature; RMS speed of gas molecules - degree of freedom - ***law of equipartition of energy and application to specific heat capacities of gases.**

UNIT - II: MECHANICAL PROPERTIES OF FLUIDS

Pressure due to fluid column - Pascal's law and its applications (Hydraulic lift and Hydraulic brakes) - effect of gravity on fluid pressure - Viscosity, terminal velocity, streamline and turbulent flow, critical velocity - ***Bernoulli's theorem and its applications**.

UNIT - III: RIGID BODY DYNAMICS

Dynamics of uniform circular motion - Centripetal force - example of circular motions (vehicle on level, circular road and banked road) - Equilibrium of rigid bodies, rigid body rotation and equations of rotational motion - Moment of inertia - radius of gyration - ***Calculation of moment of inertia for simple geometrical objects**.

Book for study

S.L. Arora, *New Simplified Physics*, Volume I and II, Publications Dhanpat Rai & Co. 7th Edition -2018.

Book for reference

Arthur Beiser, *Applied Physics*, Schaum's outlines, Tata McGraw Hill Company limited, 4thEdition, July 2020.

E-Resources

1. https://www.brainkart.com/article/Application-of-law-of-equipartition-energy-in-specific-heat-of-a-gas_36286/
2. https://www.elprocus.com/what-is-a-bernoullis-theorem-derivation-its-limitations/
3. https://en.wikipedia.org/wiki/List_of_moments_of_inertia

Course Title	Core Practical – 1: General Experiments - I	**Course Code**	
Year	I	**Semester**	II
Hours/week	3	**Credits**	3

COURSE OBJECTIVES

This course offers the students to

- verify certain concepts in properties of matter and geometrical optics
- verify some elementary concepts in electricity and magnetism.
- train students in handling instruments independently and measure to precision.

COURSE OUTCOMES (CO)

At the end of the course, the students will be able to

CO1	understand error analysis using vernier caliper and Screw Gauge.	K2,K4
CO2	measure mechanical, and optical parameters of materials	K3
CO3	Determine electrical and magnetic property and values of materials.	K3
CO4	calibrate electrical measuring instruments.	K4
CO5	handle instruments independently and measure precisely.	K3

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	S	S		S	M	S	S	S
CO2	M	M	S	S	S		S	M	S	S	S
CO3	M	M	S	S	S		S	M	S	S	S
CO4	S	M	M	S	S		M	M	S	S	S
CO5	S	S	M	S	S		M	M	S	M	S

S - Strong; M - Medium; L - Low

Any Fifteen of the Following Experiments:

1. Error Analysis I (Vernier Caliper, Physical Balance, Screw Gauage).
2. Error Analysis II (Spectro meter, Travelling Microscope).
3. Young's Modulus-Non uniform bending (Pin & Microscope method).
4. Young's Modulus - Cantilever depression (Pin & Microscope method).
5. Rigidity modulus – Torsional Pendulum.
6. Compound Pendulum – Determination of 'g'.
7. Surface tension – Capillary rise.
8. Metre bridge – Resistance and specific resistance.
9. Sonometer – Frequency of tuning fork.
10. Surface tension – Method of drops.

11. Newton's law of cooling.
12. Determination of 'M'–Tan C position.
13. Potentiometer – low range voltmeter calibration.
14. Spectrometer – Refractive Index – Prism.
15. Spectrometer – Grating (Normal incidence method).
16. Potentiometer - low range ammeter calibration.
17. Comparison of viscosity's – Poisuille's flow method.
18. Liquid lens – Refractive index of liquid.

Books for reference

1. C. L. Arora, *Practical Physics*, S.Chand& Co., 2009.
2. R. K. Shukla and Anchal Srivastava, *Practical Physics*, New Age International Publishers, 1st edition, 2013.
3. D. Chattopadhyay and R.C. Rakshit, *An Advanced Course in Practical Physics*, New Central Book Agency, 10th edition, 2011.

Pedagogy

Chalk and talk, PPT, Equipment demonstration, Skill Innovative Task, Interaction

Course Title	Core Practical – 2: Electronics Experiments	**Course Code**	
Year	I	**Semester**	II
Hours/week	2	**Credits**	2

COURSE OBJECTIVES

This course offers the students to

- verify characteristics of junction diode, rectifier circuits and IC regulated power supply.
- familiarize the output response of the various logic gates with respect to input condition.
- handle instruments independently and measure precisely.

COURSE OUTCOMES (CO)

At the end of the course, the students will be able to

CO1	verify the characteristics of diode, transistor, rectifier circuits and IC regulated power suppl by constructing circuits	K3
CO2	construct the circuits and verify the truth tables of all logic gates in order to understand the basics of computer.	K2, K3
CO3	handle instruments independently and measure precisely.	K3
CO4	construct amplifiers and oscillators using transistor	K3
CO5	Do performans analysis of construted oscillator, amplifier and logic gates	K4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	M		M	S	S	S	S
CO2	S	M	M	S	M		M	S	S	S	M
CO3	M	S	M	S	S		S	M	S	S	M
CO4	M	M	S	S	M		M	S	S	M	S
CO5	M	S	M	S	M		M	S	S	S	M

S - Strong; M - Medium; L - Low

Any Fifteen of the Following Experiments

1. Junction diode characteristics.
2. Zener diode characteristics.
3. Construction of Half and Full wave rectifier.
4. Construction of 5V regulated power supply using IC.
5. Bridge Rectifier.
6. 12 – 0 – (-12) Dual IC regulated power supply
7. Zener Regulated Power supply.
8. Study of CRO- Lissajous figures.
9. Verification of truth tables of AND, OR and NOT gates.

10. Verification of truth tables of NAND, NOR and EX-OR gates.
11. NAND as universal gate.
12. NOR as universal gate.
13. Voltage Doubler.
14. Construction of Half adder and half subtractor.
15. Verify ohms law.
16. Transistor characteristics – CE mode.
17. Construction of Astable Multivibrator.
18. Single stage RC-coupled amplifier.

Books for reference

1. L. Arora, *Practical Physics*, S.Chand& Co., 2009.
2. R. K. Shukla and Anchal Srivastava, *Practical Physics*, New Age International Publishers, 1st edition, 2013.
3. Chattopadhyay and R.C. Rakshit, *An Advanced Course in Practical Physics*, New Central Book Agency, 10th edition, 2011.
4. C.C.Ouseph, U.J.Rao and V.Vijayendran, *Practical Physics and Electronics*, S. Viswanathan Printers and Publishers, 2008.

Pedagogy

Chalk and talk, PPT, Equipment demonstration, Skill Innovative Task, Interaction

Course Title	Core 5: Analog and Digital Circuits	**Course Code**	20UPH3C05
Year	II	**Semester**	III
Hours/week	5	**Credits**	5

COURSE OBJECTIVES

- To impart the knowledge of the basic principles of semiconductor materials and devices.
- To understand the performance of Transistor amplifiers, OP-AMP, rectifiers and oscillators.
- To study the concepts of rectifiers and construct the power supplies and various number system and codes.

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	Acquaint about basic principles of semiconductor materials and devices.	K1
CO2	explore the various parameters of Transistor amplifiers, OP-AMP and Oscillators	K2
CO3	Elucidate the concepts of rectifiers and able to design own power supplies.	K3
CO4	Differentiate analog and digital systems and to work with various number systems involved in computer technology	K4
CO5	design and develop digital circuits, essential for calculation and processing,	K4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

MAPPING

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	L	M		S	S	S	M	L
CO2	S	M	M	S	M		S	S	M	S	L
CO3	S	S	M	M	M		S	S	S	S	M
CO4	S	M	S	S	M		S	S	S	M	S
CO5	M	S	S	S	L		S	S	M	S	S

S - Strong; M - Medium; L - Low

UNIT - I: SEMICONDUCTOR FUNDAMENTALS

Energy band in solids - types of semiconductor - majority and minority carriers - Mobile charge carriers and immobile ions - drift current in intrinsic semiconductor - PN junction - Depletion layer - barrier voltage - Effect of temperature - forward biased and reverse biased pn junction - Avalanche breakdown - Zener breakdown - Tunnel diode - Varactor diode - PIN diode – ***LED - Diode characteristics**

UNIT - II: AMPLIFIERS AND OSCILLATORS

Amplifiers: Transformer coupled Class A amplifier - Class B push-pull amplifier – RC and Impedance coupled two stage amplifiers -Distortion in amplifiers – H parameters in CE and CB configuration

Oscillators: Comparison between an amplifier and oscillator – Damped and undamped Oscillations – Tuned base oscillator – ***Tuned collector oscillator** - Hartley and ***Wien bridge oscillator** - Crystal controlled Oscillator - Phase shift oscillator -Astable, ***Monostable** and Bistable multivibrator.

UNIT – III: RECTIFIERS AND OPERATIONAL AMPLIFIER

Rectifiers - Half wave - full wave rectifiers - Ripple factor - ***Voltage regulation using Zener diode** - Limiters, Clippers, Clampers - Characteristics of ideal and practical operational amplifiers - Unity gain follower - Parameters of OP-AMP - Adder -Subtractor - Integrator - Differentiator - Comparator - Low pass, High pass and Band pass filter Circuits

UNIT - IV: NUMBER SYSTEMS

Difference between Analog and Digital circuits - Decimal, Binary, Octal and Hexadecimal number system - Conversions between them - Advantages of Octal and Hexadecimal number system - Binary addition, subtraction and multiplication - 1s and 2s complements - BCD - Signed and Unsigned numbers - Weighted and non-weighted codes - ASCII code -***Gray to Binary and Binary to Gray conversion.**

UNIT - V: DIGITAL FUNDAMENTAL AND DEVICES

Boolean laws - Associative and distributive properties - Basic and Derived logic gates (AND, OR, NOT, XOR, NAND, NOR and XNOR) - ***Demorgan's theorem** - NAND and NOR as a universal gates - Half adder - Full adder - Half subtractor - Full subtractor - Four Bit binary adder - RS and J-K flip flops - R-2R ladder Digital to Analog Converter - Counter type Analog to Digital converter

Books for study

1. B L Theraja, *Basic Electronics*, S.Chand and Company Ltd, 11th Edition, Reprint 2019.
2. V. Vijayendran, *Introduction to Integrated Electronics Digital and Analog*, Viswanathan, S., Printers & Publishers Pvt Ltd, 1st Edition, 2009.
3. Malvino and Leach, *Digital Principles & Applications*, Publication: McGraw Hill Company, 8th Edition, 2014,

Book for reference

V.K. Mehta, Rohit Mehta, *Principles of Electronics*, S. Chand and company, 12th Edition, 2020.

E-Resources

1. http://ocw.mit.edu/courses/#physics
2. http://hyperphysics.phy-astr.gsu.edu
3. https://www.coursera.org
4. https://nptel.ac.in/courses/115/102/115102014/

Course Title	Core 6: Heat, Thermodynamics and Statistical Mechanics	**Course Code**	20UPH4C06
Year	II	**Semester**	IV
Hours/week	5	**Credits**	5

COURSE OBJECTIVES

To enable the students to

- know about kinetic theory of gases and transport phenomena
- understand thermal conduction and radiation
- impart knowledge on principle and different methods of production of low temperature and liquefaction of gases
- familiarize in thermodynamic laws and three types of thermo dynamical statistics

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	elucidate the behavior of gas laws and the principle of kinetic theory	K1
CO2	assimilate the significance of thermal conduction and radiation	K2
CO3	compare the various methods of production of low temperature	K3
CO4	apply the principles and laws to determine the entropy of a system	K3
CO5	calculate the efficiency of heat engines distinguish classical statistics and quantum statistics	K4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	L		S	S	M	M	M
CO2	M	S	S	M	L		S	S	S	M	M
CO3	M	S	M	S	M		M	S	S	S	M
CO4	S	M	S	S	L		S	S	M	S	S
CO5	M	M	S	S	L		M	M	S	S	M

S - Strong; M - Medium; L - Low

UNIT - I: KINETIC THEORY OF GASES AND TRANSPORT PHENOMENA

Postulates of kinetic theory of gases- Expression for the pressure exerted by gas- rms speed- kinetic energy per unit volume of a gas- Derivation of gas equation and gas laws- Graham's law of diffusion of gases.

***Molecular Collision- Sphere of influence**-Clausius' expression for mean free path- Transport phenomena- Viscosity: transport of momentum- Thermal conductivity: transport of thermal energy- Diffusion: transport of mass.

UNIT- II: TRANSMISSIONOF HEAT

Coefficient of thermal conductivity- Forbe's method -Lee's method for bad conductors -Thermal conductivity of Rubber - Radial flow of heat - Cylindrical flow of heat- Widemann Franz's law - Stefan's law and verification - Wein's law, Rayleigh Jeans law and Planck's law -***Solar constant** - **Surface temperature of sun** -Angstrom's Pyroheliometer.

UNIT - III: LOW TEMPERATURE PHYSICS

Porous plug experiment - Theory of Porous plug experiment and its results - Joule Kelvin effect - Temperature of inversion - Relation between Boyle temperature, temperature of inversion and critical temperature - Liquefaction of air- Linde's process -***Liquefaction of hydrogen**, Liquefaction of helium- K.Onnes method - Helium I and II -***Adiabatic demagnetization**

UNIT - IV: THERMODYNAMICS

First law of Thermodynamics - Determination of γ-Clement and Desormer's method -Second law of thermodynamics -***Carnot engine Otto Cycle**-Clausiusclapeyron'slatent heat equation and itsapplications -Entropy -Third law of thermodynamics -Entropy of a perfect gas -Entropy diagram -Zero point energy -Maxwell's Thermo dynamical relations.

UNIT - V: STATISTICAL MECHANICS

Statistical equilibrium - Maxwell Boltzmann distribution Law - Maxwell Boltzmann distribution in terms of temperature -Ideal gas- Quantum statistics -Phase space - Bose Einstein statistics - Distribution law -Photon gas - Fermi Dirac statistics -Distribution law -Electron gas - ***Comparison of three statistics.**

Book for study

Brijlal and Subramanyam, *Heat and Thermodynamics and Statistical Physics*, S. Chand & Company, 16th Edition, Reprint 2018.

Books for reference

1. D.S. Mathur, *Heat and Thermodynamics*, S.Chand and Company, 5th Edition 2008.
2. A.B Gupta & H.P. Rai, Thermal Physics, New central book, 3rdEdition, 2010.

E-Resources

1. https://en.wikipedia.org/wiki/Heat_transfer
2. https://en.wikipedia.org/wiki/List_of_thermal_conductivities
3. http://ocw.mit.edu/courses/#physics
4. http://hyperphysics.phy-astr.gsu.edu
5. https://www.coursera.org
6. https://nptel.ac.in/courses/115/102/115102014/

Course Title	Core Practical – 3: General Experiments - II	**Course Code**	
Year	II	**Semester**	IV
Hours/week	3	**Credits**	3

COURSE OBJECTIVES

This course offers the students to

- determine the elastic moduli of different material and wires.
- study the wavelength of given source of light and spectrum produced by optical devices.
- improve the skill in the determination of optical, electrical, magnetic and thermal parameters using appropriate instruments.

COURSE OUTCOMES (CO)

At the end of the course, the students will be able to

CO1	determine the elastic moduli of different material and wires used in various fields like civil, metallurgy etc.	K3
CO2	find the wavelength of given source of light a nd spectrum produced by optical devices.	K3
CO3	determine optical and thermal parameters using spectrometer, polarimeter and calorimeters	K3
CO4	evaluate mechanical electrical and magnetic values of materials	K4
CO5	handle the thermal, optical, electrical and calorimetry instruments effectively	K2

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S		S	M	S	S	S
CO2	M	S	S	S	M		M	M	S	S	S
CO3	S	M	S	S	S		S	M	S	S	S
CO4	M	M	S	S	S		M	S	S	S	S
CO5	S	M	M	S	S		S	M	S	S	S

S - Strong; M - Medium; L - Low

Any fifteen of the following experiments:

1. Young's modulus - uniform bending (Optic lever Method).
2. Young's modulus – Cantilever Oscillations.
3. Rigidity Modulus – Static torsion (Scale and telescope).
4. Metre bridge - TCR.
5. Melde's string method – Determination of frequency.
6. Thermal conductivity – Lee's disc method.
7. Spectrometer-dispersive power of the prism.

8. Determination of Band gap energy of a Thermister.
9. Spectrometer – Hollow prism.
10. Spectrometer i-d curve.
11. Newton's ring – Radius of curvature
12. Field along the axis of the coil – Determination of B_H.
13. Spectrometer – Small angled prism.
14. Young's modulus - Koenig's Method.
15. Sonometer – A.C frequency.
16. Polarimeter – Specific rotation.
17. Joules calorimeter – Specific heat capacity of liquid.
18. Air Wedge – Thickness of the Wire.

Books for reference

1. C. L. Arora, *Practical Physics*, S.Chand& Co., 2009.
2. R. K. Shukla and Anchal Srivastava, *Practical Physics*, New Age International Publishers, 1st edition, 2013.
3. D. Chattopadhyay and R.C. Rakshit, *An Advanced Course in Practical Physics*, New Central Book Agency, 10th edition, 2011.

Pedagogy

Chalk and talk, PPT, Equipment demonstration, Skill Innovative Task, Interaction

Course Title	Core Practical – 4: Analog and Digital Experiments	**Course Code**	
Year	II	**Semester**	IV
Hours/week	2	**Credits**	2

COURSE OBJECTIVES

This course offers the students to

- understand the working of OP-AMP and its applications.
- improve skill in the construction of electronic circuits using OP-AMP.
- construct digital circuits using ICs.

COURSE OUTCOMES (CO)

At the end of the course, the students will be able to

CO1	understand working of OP-AMPs and its applications.	K2
CO2	construct analog circuits using OP-AMP.	K3
CO3	Utilize 555 timer for various applications	K3
CO4	construct digital circuits using ICs.	K3
CO5	Verify and analyse the logic circuits	K4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	S		S	M	S	S	S
CO2	M	S	S	S	M		M	M	S	S	S
CO3	S	S	M	S	S		S	M	S	S	S
CO4	M	M	S	S	S		M	S	S	S	S
CO5	S	M	M	S	S		S	M	S	S	S

S - Strong; M - Medium; L - Low

Any fifteen of the following experiments:

1. OP-AMP – Adder and Subtractor.
2. OP-AMP – Inverting and non-inverting amplifier.
3. Parameters of OP-AMP.
4. OP-AMP – Integrator and Differentiator.
5. Low pass filter - OP-AMP.
6. High pass filter - OP-AMP.
7. Band pass filter - OP-AMP.
8. Unity Gain follower- OP-AMP.

9. Parallel resonant circuit.
10. Series resonant circuit.
11. Astable multivibrator -555 Timer.
12. Two Input OR and AND gates using diode and transistor.
13. Construction of Full adder.
14. Construction of Full subtractor.
15. 4-bit Binary adder.
16. RS Flip Flop.
17. Verification of De Morgan's theorem.
18. Analog to Digital converter.

Books for reference

1. L. Arora, *Practical Physics*, S.Chand& Co., 2009.
2. R. K. Shukla and Anchal Srivastava, *Practical Physics*, New Age International Publishers, 1st edition, 2013.
3. Chattopadhyay and R.C. Rakshit, *An Advanced Course in Practical Physics*, New Central Book Agency, 10th edition, 2011.
4. C.C.Ouseph, U.J.Rao and V.Vijayendran, *Practical Physics and Electronics*, S. Viswanathan Printers and Publishers, 2008.

Pedagogy

Chalk and talk, PPT, Equipment demonstration, Skill Innovative Task, Interaction

Course Title	Core 7: Mathematical Physics and Classical Mechanics	**Course Code**	20UPH5C07
Year	III	**Semester**	V
Hours/week	5	**Credits**	5

COURSE OBJECTIVES

To facilitate the students to familiarize

- vector calculus
- spherical and cylindrical coordinate system and matrices
- Laplace transforms
- complex variables and special functions
- Lagrangian dynamics

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	Know about the scalar and vector fields, identities and theorems	K1
CO2	formulate variety of physical systems by means of various coordinate systems with the benefit of vector concepts.	K2
CO3	Solve electrical circuit problems using concept of Laplace transformation	K4
CO4	assimilate complex variables and special functions	K2
CO5	setup Lagrange's equation of motion for mechanical, electrical and harmonic systems	K3

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	L	L		S	S	S	S	L
CO2	S	S	S	M	M		S	S	M	S	M
CO3	S	S	S	S	M		S	S	S	M	M
CO4	M	S	S	M	M		M	S	S	S	M
CO5	M	S	S	S	S		M	S	S	S	M

S - Strong; M - Medium; L - Low

UNIT - I: VECTOR CALCULUS

Gradient of a scalar field - line, surface and volume integral - Divergence of a vector function - examples - Curl of a vector function -***Important vector identities** - Gauss divergence theorem - Stoke's theorem - Green's theorem - examples.

UNIT - II: COORDINATE SYSTEMS AND LAPLACE TRANSFORMATION

Orthogonal curvilinear coordinates - Cylindrical coordinates - Spherical polar coordinates - Curl, Divergence and Gradient in terms of curvilinear, ***cylindrical and spherical polar coordinates.**

Laplace transforms: Definition - important formulae - properties of Laplace transforms - Laplace transform of the derivative of a function f(t).

UNIT - III: MATRICES

Special types of matrices -Properties of unitary and orthogonal matrices -Eigen values and Eigen functions- Cayley - Hamilton theorem - Diagonalisation of matrix - Hermitian matrix - Skew Hermitian matrix - Non-symmetric matrix with Non-repeated Eigen values - Repeated Eigen values - ***Symmetric matrices with Non-repeated Eigen Values - Repeated values.**

UNIT - IV: COMPLEX VARIABLES AND SPECIAL FUNCTIONS

Complex analysis - Analytic functions - Cauchy - Riemann equations- Cauchy's Integral theorem - Integral formula - Residues -***Residue theorem (Evaluation of Definite integrals of trigonometry functions of cos θ and sin θ only).**

Special Functions: Definition - Beta function - Gamma function - Evaluation of Beta function - Evaluation of Gamma function - Relation between Beta and Gamma functions.

UNIT - V: LAGRANGE'S FORMULATION

Conservation theorem for linear and angular momentum and energy - Degrees of freedom – Constraints- Generalized displacement, velocity, acceleration, momentum - Principle of virtual work - D' Alembert's principle - Lagrange's equation of motion - Application of Lagrange's equation of motion to linear Harmonic Oscillator, Simple Pendulum Compound Pendulum, ***Atwood's machine, LCR circuit**.

Books for study

1. Satya Prakash, *Mathematical Physics with Classical Mechanics*, Sultan Chand & Sons, 6th Edition, Reprint 2014.
2. H.K. Dass and Dr. Rama Verma, *Mathematical Physics*, Sultan Chand & sons, 8th Edition, Revised 2018.

Books for reference

1. B.D.Gupta, *Mathematical Physics*, Vikas Publishing house, 4th Edition, 2010.
2. R. Murugeshan, *Mechanics and Mathematical Physics*, S. Chand and co, Ram Nagar, New Delhi, 4th Edition 2020.

E-Resources

1. http://ocw.mit.edu/courses/#physics
2. http://hyperphysics.phy-astr.gsu.edu
3. https://www.coursera.org
4. http://nptel.ac.in/courses/115106090/
5. https://en.wikipedia.org/wiki/Lagrangian_mechanics

Course Title	Core 8: Optics	**Course Code**	20UPH5C08
Year	III	**Semester**	V
Hours/week	5	**Credits**	5

COURSE OBJECTIVES

The key objective of this paper is that

- students are acquainted with Nature of light and Velocity of light.
- they can understand basic phenomenon of Diffraction, Interference, Polarization.
- they can be experienced the working principles of optical Instruments, laser and optical fiber.
- they can understand and gain knowledge about different theories, optimum conditions and optical instrumentations.

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	enrich the level of understanding on determination of different parameters like focal length, magnification, refractive index of different medium, wavelength, thickness, velocity of light, specific rotation etc.,	K1
CO2	Assimilate theories and production of interference, uses of interferometers and to determine refractive indices of optical materials using variety of refractometers methods.	K2
CO3	Know about the concept of diffraction, utility of diffractometers and its uses in spectral Analysis.	K2
CO4	Analyze Polarization through optical activity of the medium and work with crystal technologies.	K4
CO5	Apply these ideas on fabricating different optical spare parts for various applications such as setting up of microscope, telescope and camera lenses.	K3

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	M		S	S	M	M	M
CO2	S	S	S	S	M		S	S	M	S	M
CO3	S	S	M	S	M		S	S	S	S	M
CO4	M	S	M	S	M		S	M	S	S	S
CO5	S	M	M	S	S		S	S	M	S	M

S - Strong; M - Medium; L - Low

UNIT - I: NATURE OF LIGHT AND VELOCITY OF LIGHT:

Newton's corpuscular theory- reflection of light on corpuscular theory- refraction of light on corpuscular theory-origin of wave theory-reflection of a spherical wave front at a plane surface-reflection of a spherical wavefront at a spherical surface-Refraction of a spherical wave front at a plane surface- refraction of a spherical wavefront at a spherical surface.

Velocity of light:Foucault's rotating mirror method- Michelson's modification of Foucault's method- Rotating mirror null method-Kerr cell method- Houston's method- ***Refraction through a convex and concave lenses.**

UNIT - II: INTERFERENCE

Coherent sources - phase difference and path difference- theory of interference fringes - Fresnel's Biprism - Lloyd's single mirror- Billet's split lens-Newton's rings - Determination of the wavelength of the sodium light - Refractive index ofa liquid - Newton's rings with white Light - Haidinger's fringes - Michelson Interferometer - visibility of fringes – applications- Determination of the difference in wavelength between two neighboring spectral lines - Determination of the refractive index of thin transparent plates -Determination of the refractive index of gases - Jamin's Refractometer - Mach-Zehnder refractometer - Rayleigh's Refractometer – Fabry Perot – Interferometer -***Holography- *Temporal coherence- *Spatial coherence.**

UNIT - III: DIFFRACTION

Fresnel assumptions - Rectilinear propagation of light - Zone plate -action of zone platefor an incident spherical wave front - difference between a zone plate and a convex lens-Fresnel and Fraunhofer Diffraction - diffraction at a circular aperture- diffraction at anopaque circular disc Fresnel Diffraction at a Straight edge- intensity at a point inside thegeometrical shadow (straight edge) - Fresnel Diffraction at a narrow slit and Narrow wire-Fraunhofer Diffraction at a Double slit - Dispersive power of grating-*C**oncave reflecting grating- Echelon grating.**

UNIT - IV: POLARISATION

Polarization of transverse waves - plane of polarization- Brewster's law- Optic axis in the plane of incidence and inclined to the crystal surface - Optic axis in the plane of incidence and parallel to the crystal surface - Optic axis in the plane of incidence and perpendicular to the crystal surface- Quarter wave plate and half wave plate - Production and Detectionof Plane, Circularly and Elliptically Polarized light - Babinet's compensator –Dichroism- Fresnel's Rhomb-Optical activity - Fresnel's Explanation of optical rotation - Experimental verification -Specific rotation: Laurent's half shade polarimeter –Lippich Polarimeter-***Huygen's theory for uniaxial crystals**

UNIT - V: OPTICAL INSTRUMENTS

Telephoto lens - microscope: simple microscope- electron microscope Telescope: angular magnification of telescope - Terrestrial telescope - Galileo's telescope - Eye pieces: Huygens - Cardinal points of Huygen's eyepiece - Ramsden eyepiece- cardinal points of Ramsden eyepiece- Gauss eyepiece - comparison of Huygen's and Ramsden eyepiece-Abbe's Homogeneous oil immersion objective - Types of reflecting telescope – Lasers- spontaneous and stimulated emission and Einstein's A and B coefficients- Population inversion -Ruby laser- Helium-Neon laser- optical fibre system- ***Optical fibre cable -The three types of fibres.**

Book for study

N. Subrahmanyam and Brijlal, *A Textbook of Optics,* S.Chand & Company Ltd, New Delhi, 25th Reprint 2020.

Books for reference

1. Subir Kumar Sarkar, *Optical Fibers and Fiber Optic Communication Systems,* S.Chand & Co, 6th Edition, 2001
2. R.Murugeshan and Kiruthiga sivaprasath, *Modern Physics,* S. Chand & Company Private Ltd., New Delhi, 18th Edition, 2019.
3. Ananthakrishanan, *A text book of light,* S.Viswanathan& co, Chennai, 2nd Edition,1966.

E-Resources

1. https://en.wikipedia.org/wiki/Diffraction
2. http://hyperphysics.phy-astr.gsu.edu
3. https://byjus.com/physics/optical-instruments
4. https://nptel.ac.in/courses/115/102/115102014/

Course Title	Core 9: Atomic Physics and Spectroscopy	**Course Code**	20UPH5C09
Year	III	**Semester**	V
Hours/week	5	**Credits**	5

COURSE OBJECTIVES

To enable the students to know about the

- various atom models and atomic spectra
- periodic classification of elements
- behavior of an atom under the influence of electric and magnetic field
- selection rules for Raman and IR spectra in terms of symmetries of molecular vibrations

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	Gain knowledge about structure of atoms, various atomic models and production of atomic spectra.	K1
CO2	Clarify the importance of various atomic models and electronic configuration of elements.	K2
CO3	analyze the behavior of an atom under the influence of electric and magnetic field with appropriate experimental setups	K4
CO4	distinguish classical and quantum theory of Raman effect	K2
CO5	Apply different spectroscopic techniques to study the spectrograph obtained from spectroscopic devices.,	K3

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	L		S	S	M	M	M
CO2	M	S	S	S	M		S	S	M	M	M
CO3	M	S	S	M	M		S	S	S	S	M
CO4	M	S	S	M	M		M	S	M	S	M
CO5	M	S	S	S	M		S	S	M	S	S

S - Strong; M - Medium; L - Low

UNIT-I: STRUCTURE OF THE ATOM

Rutherford's experiments on α particle scattering - Experimental verification- Bohr's atom model - Critical potentials - Atomic excitation - Experimental determination of critical potentials - Franck and Hertz method - Davis and Goucher's method - ***Mass spectrograph: Dempster's mass spectrograph**- Aston's mass spectrograph.

UNIT- II: ATOM MODEL AND ATOMIC SPECTRA

Sommerfeld's relativistic atom model - The Vector atom model - Quantum numbers associated with the vector atom model - Coupling schemes - Electronic configuration of elements - The Pauli's exclusion principle - magnetic dipole moment due to orbital and spin - The Stern and Gerlach Experiment - Spectral terms and notations -***selection rules - intensity rule and interval rule** - Fine structure of sodium D lines

UNIT- III: OPTICAL SPECTRA

Zeeman effect - Experimental arrangements - Expression for Zeeman shift - Quantum mechanical explanation of normal Zeeman effect - Larmor's theorem - Paschen back effect - Stark effect - Mosley's law and its importance - X-ray spectra - Continuous spectrum - Characteristic spectrum - Compton effect - Expression for Compton shift (dλ) - Photo electric effect - Richardson and Compton experiment - Einstein's Photo electric equation - Millikan's experiment - ***Photo voltaic cell**.

UNIT- IV: MOLECULAR SPECTRA AND RAMAN EFFECT

Molecular spectra: Introduction - Origin of molecular spectra - Nature of molecular spectra - Rotation of linear system - Non rigid rotator -Theory of the origin of pure rotational spectrum of a molecule - Electronic spectra of molecule.

Raman effect: Experimental study of Raman effect** -Quantum theory of Raman effect -Laser Raman spectroscopy** - Classical theory of Raman effect - Vibrational Raman spectra of diatomic molecules - Pure rotational Raman spectra

UNIT-V: SPECTROSCOPIC TECHNIQUES

The energy of a diatomic molecule - Vibrating diatomic molecule as a harmonic oscillator - Spectroscopic techniques - Constant deviation spectrograph - Recording the spectrum - UV spectroscopy - Quartz spectrograph for near UV region - Littrow spectrograph - Infra red spectroscopy - Wadsworth Prism-Mirror spectrograph - ***Absorption spectroscopy -*Double beam IR spectrometer**.

Book for study

R.Murugeshan and Kiruthiga sivaprasath, *Modern Physics*, S. Chand & Company Private Ltd., New Delhi, 18th Edition, 2019.

Books for reference

1. Rita Kakkar, Atomic and Molecular Spectroscopy, 1st Edition, 2015
2. Gupta Kumar Sharma, *Elements of Spectroscopy*, Pragati prakashan, Meerut, 25th Edition, 2012.

E-Resources

1. http://ocw.mit.edu/courses/#physics
2. http://hyperphysics.phy-astr.gsu.edu
3. https://courses.lumenlearning.com
4. https://www.coursera.org
5. https://nptel.ac.in/courses/115/102/115102014/
6. https://www.nptel.ac.in/content/storage2/courses/102103044/pdf/

Course Title	Core 10: Microprocessor and its Physics Applications	**Course Code**	20UPH5C10
Year	III	**Semester**	V
Hours/week	5	**Credits**	5

COURSE OBJECTIVES

To enable the students to

- understand the basics of Microprocessor, Microcomputers and their developments.
- familiarize the instruction format and instruction set used in second generation microprocessor
- utilize the instruction sets and Hex codes for developing assembly level programming
- augment in interfacing of programmable electronic equipment's using 7427, 8255 and 8259
- incorporate the technical skills in application-oriented programming

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	understand the architecture of Microprocessor, Microcomputers and their developments.	K1
CO2	handle the instruction format and instruction set in assembly level programming used in second generation microprocessor	K2
CO3	write application-oriented assembly level programming for microcontrollers and microprocessors-based systems like stepper motor controls and traffic control systems etc.,	K3
CO4	Develop skills to interface variety of programmable controllers with 8085 processor in research and technology	K3
CO5	acclimate the techniques involved in interfacing memory and interrupt controllers and their utility in the field of computer technology	K4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	M		S	S	S	M	M
CO2	S	S	S	M	M		M	S	S	M	M
CO3	M	S	M	S	S		S	M	S	S	S
CO4	M	S	M	S	M		S	M	S	S	L
CO5	M	M	S	S	M		S	M	S	S	S

S - Strong; M - Medium; L - Low

UNIT - I: INTRODUCTION TO INTEL 8085 MICROPROCESSOR AND MEMORY

Evolution of Microprocessor-First, second, third and fourth generation microprocessors-Microprocessor based systems - Micro, Mini and Large computers - Advantages and disadvantages of microprocessor based system - General description of Intel 8085 - Pin configuration - 8085 Signal description summary - Intel 8085 architecture - Machine cycles of 8085-T-states-Opcode fetch machine cycle of 8085- ***Memory read/write Machine cycle of 8085*.**Introduction to

memory - Semiconductor memory - ROM, PROM, EPROM, static RAM, DRAM and NOVRAM.

UNIT - II: INSTRUCTION SETS AND BASIC PROGRAMMING

Instruction format of 8085 – Hexcode- Basics of Addressing modes- Instruction set - Data transfer Instructions - Arithmetic instructions - ADD reg; ADI d8; ADD M; ACI d8; ADC reg; ADC M; SUB reg; SUI d8; SUB M; SBB reg; SBI d8; SBB M; DAA; DAD rp; INR reg; INR M; DCR reg; DCR M; INX rp and DCX rp with examples. Logical instructions - ANA reg; ANI d8; ANA M; ORA reg; ORA M; ORI d8; XRA reg; XRI d8; XRA M; CMP reg; CPI d8; CMP M; CMA; STC; CMC; RLC; RRC;RAR and RAL with examples.Branching instructions- JMP addr16; J<condition>addr 16; CALL addr 16; C <condition>addr 16; RET; R <condition> ;RSt n; ***Machine control instructions PCHL; DI; EI; SIM; RIM HLT and NOP with detailed descriptions.**

UNIT- III: ASSEMBLY LANGUAGE PROGRAMMING

Assembler - need for assembler -advantages of assembler - symbols and representation in Flow Charts. Instruction execution and data flow in 8085-Programme to transfer data between memory and accumulator - 1's and 2's complement of 8 bit data - Programme to add two 8 bit data - Subtract two 8 bit data - Subtract two BCD data.Programme to add two 16 bit data - Add two BCD data - add an array of data - Programme to sort an array of data in Ascending and Descending order- Programme to multiply two numbers of 8 bit data -Programme to search a smallest in the given array of data.***Assembly level programming for Binary to Gray - Gray to Binary conversion- Programme to find the square root of a given binary number.(Algorithm, flowchart and programming. Self-study through online)**

UNIT- IV: MEMORY INTERFACING AND INTERRUPTS

Interfacing SRAM and EPROM - Memory capacity - Choice of memory IC's and address allocation I/O structure of typical microcomputer - Interfacing I/O devices and peripheral IC's - I/O device mapping (simple descriptions) -comparison of memory mapping and I/O mapping- DMA data transfer scheme. Needs for interrupts - Types of interrupts - Polling of interrupts - Interrupt driven data transfer scheme - 8259 Programmable interrupt controller - 8255 peripheral interface***Data transfer schemes - Synchronous data transfer scheme - Asynchronous data transfer scheme**

UNIT- V: APPLICATIONS OF MICROPROCESSOR

Temperature control system - motor speed control system - Traffic control system - Keyboard interfacing using ports.***Subroutine- Delay routine-writing practice for different delay routine to produce a time delay in 8085 processor based system whose clock frequency is 3 MHz. and 6 MHz.**

Book for study

A.Nagoorkani, 8085 *Microprocessor and its applications*, Tata McGraw hill Education, India, 3rd edition 2017.

Books for reference

1. A.P Mathur, *Introduction to Microprocessor*, Tata McGraw Hill, 3rd Edition, 2017.
2. Ramesh Gaonkaer, *Microprocessor and its Application*, Penram Publication, Mumbai, 6th Edition, 2013.

E-Resources

1. www.tutorialspoint.com
2. https://www.coursera.org
3. https://nptel.ac.in/courses/106/108/106108100/

4. https://scanftree.com/microprocessor/Applications-of-Microprocessors
5. https://www.academia.edu/8721278

Course Title	Core 11: Relativity, Wave Mechanics and Space Physics	**Course Code**	20UPH6C11
Year	III	**Semester**	VI
Hours/week	5	**Credits**	5

COURSE OBJECTIVES

To acquire sufficient knowledge on

- properties of different physical parameters in inertial and non-inertial frames
- experimental evidence of dual nature of matter waves
- Schrödinger equation to microsystem based problems
- Quantum mechanical operators and commutation relations
- universe, sun, planets, asteroids, comets and satellites

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	Know about postulates and theories of relativity, basics of quantum mechanical concepts such as operators and eigen functions. Elucidate details of space physics.	K1
CO2	Elaborate experimental evidences of dual nature of matter waves	K2
CO3	Handle operators, functions involved in quantum equations associated to sub atomic problems	K2
CO4	Setting up of quantum equations for sub atomic systems and to analyze their behaviors.	K4
CO5	portray the principle associated to stellar evolution, concept of space physics and launching mechanism of satellites and rockets	K3

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	M		S	S	M	M	L
CO2	M	S	M	S	M		M	S	S	M	M
CO3	S	M	S	M	M		M	S	S	S	M
CO4	M	S	S	S	M		M	S	S	M	S
CO5	S	M	S	M	L		S	S	M	M	M

S - Strong; M - Medium; L - Low

UNIT - I: RELATIVITY

Frame of Reference - inertial and non-inertial frames - Michelson-Morley Experiment – GallileanTransformation and Newtonian Relativity - ***General theory of relativity - Predictions on general theory of relativity** - Fundamental Postulates of Special Theory of Relativity - Lorentz

Transformation Equations - Length Contraction and Time Dilation - Law of Addition of Velocity - Variation of Mass with Velocity - Equivalence of Mass and Energy.

UNIT - II: ORIGIN OF WAVE MECHANICS

De Broglie hypothesis - Concept of Phase Velocity and Group Velocity - Relation between group velocity and wave velocity - Experiments of Davisson and Germer and G.P. Thomson - Wave packet - Heisenberg uncertainity principle and its proof - Illustrations - Diffraction of electrons by a slit - Gamma ray microscope - Applications of uncertainity principle - Non-existence of electrons in the nucleus -***Radius of Bohr's first orbit of hydrogen atom and energy of ground state.**

UNIT - III: FORMULATION OF WAVE MECHANICS

Wave function for a free particle -Physical interpretation of wave function Schrodinger's one-dimensional wave equation - Time dependent and independent parts - Solution of Schrodinger equation for Particle in a box, Rigid rotator and ***Linear harmonic oscillator** - Postulates of quantum mechanics - Probability current density -Ehrenfest's theorem.

UNIT - IV: OPERATOR FORMALISM

Operators in quantum mechanics - Eigen values and functions - Eigen value equations - Orthogonality of Eigen functions - Significance of various quantum numbers - n, l, m_l -Operators for momentum, kinetic energy and total energy - Orbital angular momentum operator - Commutation relation between position and momentum, H and P, the components of L, L^2 with L_x, L_y and L_z -***Ladder operators L_+ and L_-**

UNIT - V: SPACE PHYSICS

Planets - Interior and Exterior planets - Crust, Mandle and core of the earth - ***Different region of the earth** - Van Allen belts - Aurora - Periodic comets - Asteriods and Meteors - Structure of protosphere, Chromosphere, corona - Sun spots - Solar fares - Solar prominences - Constellations - Physical properties of stars - Stellar evolution - Reflecting and Refracting telescopes - Hubble telescope - Big-bang theory - ***India's achievements in space science**.

Books for study

1. R.Murugeshan and Kiruthiga sivaprasath, *Modern Physics*, S. Chand & Company Private Ltd., New Delhi, 18th Edition, 2019.
2. Swati Saluja, SathyaPrakash, *Quantum mechanics*, KedarNath , Ram Nath and co, 1st Edition 2008.
3. Baidyanath Basu, *An Introduction to Astrophysics*, Prentice Hall India, New Delhi, 2nd Edition, 2010.

Books for reference

1. G. Aruldhas, *Quantum mechanics*, Prentice-hall of India, Pvt, 2rd Edition, 2009.
2. Guptha Kumar Sharma, *Quantum mechanics*, Jai Prakash Nath Publication, 13th Edition, 2019.

E-Resources

1. http://ocw.mit.edu/courses/#physics
2. http://hyperphysics.phy-astr.gsu.edu
3. https://www.coursera.org

4. https://nptel.ac.in/courses/115/102/115102014/

5. https://en.wikipedia.org/wiki/Space_physics

Course Title	Core 12: Solid State Physics	**Course Code**	20UPH6C12
Year	III	**Semester**	VI
Hours/week	5	**Credits**	5

COURSE OBJECTIVES

- categorize the various types of crystals and identify crystal defects
- understand free electron theory and band theory of solids
- know about the superconductors and its applications
- understand the behavior of dielectric materials
- acquire the knowledge of smart materials

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	procure knowledge on elements of crystallography, structural determination, conductivity laws and theories of solids, properties of dielectric, and superconductors and new materials	K1
CO2	elucidate the concepts of free electron theory and band theory of solids	K2
CO3	use dielectric and smart materials in various fields	K3
CO4	analyze the behavior of superconductors in magnetic levitation	K4
CO5	Understand the behaviours of new materials like ceramics, shape memory alloys, biomaterials and metal matrix composites.	K2

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	M		S	S	S	M	M
CO2	M	S	S	M	M		S	M	S	S	M
CO3	M	M	S	S	M		M	S	S	M	M
CO4	M	S	S	M	M		M	S	M	S	M
CO5	S	S	M	S	L		S	S	M	M	M

S - Strong; M - Medium; L - Low

UNIT - I: CRYSTAL PHYSICS

Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - d spacing in cubic lattice - calculation of no of atoms per unit cell - Atomic radius – co-ordination number - packing factor for SC, BCC, FCC and HCP structures - ***Diamond and Graphite structures**.

X-Ray diffraction: Bragg's law - Rotating crystal method - Powder photograph method - crystal imperfection: Point defects - line defects - surface defects - volume defects - ***Effects of crystal imperfection.**

UNIT - II: ELECTRON THEORY OF SOLIDS

Electrical conduction classification of conducting materials - Drude Lorentz theory - Expression for electrical conductivity - Thermal conductivity - Expression for thermal conductivity – Wiedemann-Franz law - electrical resistivity versus temperature- Fermi surface- Fermi distribution function- ***High resistive materials- High resistive alloys -** photoelectric emission-free electron gas in three dimensions- periodic boundary conditions- The Fermi Energy failure of the free electron model.

UNIT - III: DIELECTRIC MATERIALS

Dielectric polarization -Dielectric constant and displacement vector - Different types of dielectric polarization - Frequency and temperature effects on polarization - Dielectric loss - local fields – Clausius-Mossotti relation- Solid insulating materials- ***liquid insulating materials- gaseous insulating materials** - properties of ferroelectrics.

UNIT - IV: SUPERCONDUCTORS

Super conductivity phenomena - Effect of magnetic field - Properties of Superconductors - Type I and Type II Superconductors -Meissner effect -***High Tc Superconductors -SQUIDS**. Isotope effect -Thermodynamic effects (Entrophy, Specific heat, Thermal conductivity) - Application of superconductors (Electric generators, Electric power transmission line, Magnetic levitation

UNIT - V: TYPES OF BONDING AND NEW MATERIALS

Types of bonding- Ionic bond- Characteristics of ionic bond - Covalent bond - Characteristics of covalent bond - Metallic bond - Characteristics of metallic bond-Secondary bonds: Dispersion, Dipole and Hydrogen bond - New materials: Metallic glasses - ***Fiber Reinforced Plastics (FRP) and Fiber Reinforced Metals (FRM)** - Surface Acoustic Wave materials- Applications (Delay lines and memories, frequency filter, surface acoustic wave resonator) - Metal matrix composites - Biomaterials - Ceramics - Shape memory alloys - SMART materials - conducting polymers.

Books for study:

1. S.O. Pillai, *Solid State Physics*, New Age International Publishers, 9th Edition, Revised 2020.
2. S L Gupta and Dr.V .Kumar, *Solid State Physics*, K.Nath & Co, Educational Publishers 9th Edition, 2018.

Books for reference:

1. Dr. M. Arumugam, *Material Science*, Anuradha Agencies, 1st Edition: Revised, 2018.
2. Saxena Gupta Saxena, *Solid State Physics*, Pragathi, 28th Edition: 2016.
3. Leonid V Azaroff, *Introduction to Solids*, Tata McGraw Hill Education Private Limited, NewDelhi, 34th Reprint, 2017.

E-Resources

1. https://nptel.ac.in/courses/115/104/115104109/
2. https://nptel.ac.in/courses/113/104/113104090/

3. https://www.thoughtco.com/superconductor-2699012
4. https://byjus.com/jee/properties-of-superconductors

Course Title	Core 13: Nuclear Physics	**Course Code**	20UPH6C13
Year	III	**Semester**	VI
Hours/week	5	**Credits**	5

COURSE OBJECTIVES

- Understanding of theories, laws of radio activity, half-life period and disintegration calculations.
- Assimilation of knowledge on working and applications of various nuclear detectors and accelerators
- Imparts collective knowledge on various nuclear models, forces, theories, hypothesis and theories of elementary particles and cosmic rays.
- Coagulates the design and working of nuclear reactors with safety measures.

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	Elucidate radioactivity laws, nuclear radiation detectors, nuclear models, properties of nucleus, nuclear hypothesis, types of nuclear reactions and basic theories of elementary particles.	K1
CO2	solve problems related to half-life and mean life period, age of the earth through the radio activity	K3
CO3	distinguish nuclear models and nuclear reactions	K4
CO4	Understand the behavior of cosmic rays and elementary particles	K2
CO5	perform overall analyses of nuclear power plants from a man, machine and organizational (human factors) point of view	K4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	L		S	S	M	M	M
CO2	M	S	S	M	M		M	S	M	S	M
CO3	M	S	M	S	M		M	S	S	S	S
CO4	S	M	S	M	M		M	S	S	S	M
CO5	M	M	S	S	S		M	S	M	S	S

S - Strong; M - Medium; L - Low

UNIT - I: RADIO ACTIVITY

Radio activity - Fundamental laws of Radio activity - Laws of Radioactive disintegration - Half life

- Mean life - Laws of Successive disintegration - Radioactive dating - The age of earth - biological effects of nuclear radiation- radioactive growth and decay- radioactive series - Alpha emission - properties of alpha particles - alpha spectrum - Geiger Nuttal law - Beta decay - Properties of Beta decay - Gamma ray spectrum -***Determination of the wavelength of gamma rays.**

UNIT - II: NUCLEAR ACCELERATORS AND DETECTORS

Wave Observatory detector - Proportional counter - GM counter - Wilson's cloud chamber - Bubble chamber - Spark chamber -Ionization chamber - Solid state detector - Laser Interferometer - ***Scintillation counter - Cerenkov counter** - Linear accelerator (LINAC) -Cyclotron - Betatron - Synchroton - Proton Synchroton.

UNIT- III: NUCLEAR PROPERTIES AND MODELS

Classification of nuclei - General properties of nucleus - Binding energy - Nuclear stability - Theories of nuclear composition - Nuclear forces -Meson theory of nuclear forces – Proton-electron hypothesis - Proton-neutron hypothesis - Models of nuclear structure - The Liquid drop model - ***Semi-empirical mass formula**-The Shell model **-*Collective model**.

UNIT - IV: NUCLEAR REACTIONS

The Discovery of artificial transmutation - The Q-value equation for a Nuclear reaction - Types of nuclear reactions - Energy balance in nuclear reactions and the Q-value - Threshold energy of an endoergic reaction - Nuclear fission - critical mass - chain reaction - Nuclear fusion - source of stellar energy - Transuranic elements.

***Nuclear Reactor safety Approach: Defense in depth approach in design**- operating license, Regulatory inspection - Radiation dose limits.

UNIT- V: COSMIC RAYS AND ELEMENTARY PARTICLES

Discovery of cosmic rays - latitude effect - Azimuth effect - Altitude effect - Primary and Secondary cosmic rays - cosmic ray showers - Discovery of positron - the mesons -***Van allen belts.**

Elementary Particles: Classification - Particles and anti particles - the fundamental interactions-the quark model-Conservation laws and symmetry.

Book for study

R.Murugeshan and Kiruthiga sivaprasath, *Modern Physics*, S.Chand & co., 18th Edition, 2019.

Book for Reference

1. G.Vaidyanathan, *Nuclear reactor engineering*, Publication: S.Chand & co, 1stEdition 2013.
2. Pandiya and Yadav , *Elements of Nuclear Physics*, KedarNath , Ram Nath, Meerut, 7th Edition, 2018.
3. D. C. Tayal, *Nuclear Physics,*Himalaya Publishing, 9th Edition, 2011.

E-Resources

1. https://nptel.ac.in/courses/115/106/115106087/
2. https://nptel.ac.in/courses/115/103/115103101/
3. https://en.wikipedia.org/wiki/Cosmic_ray

4. https://physicsworld.com/c/particle-nuclear/accelerators-detectors

Course Title	Core 14: Programming in C and its Physics Applications	**Course Code**	20UPH6C14
Year	III	**Semester**	VI
Hours/week	5	**Credits**	5

COURSE OBJECTIVES

- know about data types, variables, operators and functions in C programming
- understand the method of operation of differentcontrol and branching statements and functions
- familiarize in structures and unions.
- get the practice of declaring pointers and creating files.
- write the physics related application-oriented programs.

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	assimilate the basic structure of C programming, data types, variables and basic functions	K1
CO2	understand the different control, branching structure and write programmes using them	K2
CO3	Handle structure variables and unions in programme writing	K3
CO4	declare pointers and handling files in programme writing	K3
CO5	apply the programming skill in physical science, simulation and technology	K4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	M		S	M	S	M	S
CO2	S	S	S	S	M		M	S	S	S	M
CO3	M	M	S	S	M		M	M	S	S	S
CO4	M	M	S	S	M		M	M	S	S	S
CO5	M	S	M	S	S		M	M	S	S	S

S - Strong; M - Medium; L - Low

UNIT - I: C LANGUAGE FUNDAMENTALS

History of C-language - Basic Structure of C Programming - Character set - Constants - Variables - Data Types - Operators and Expression - Escape Sequence Characters - Library Functions - Input and Output statements: scanf - printf - getchar - putchar - gets - puts. ***Example Programmes:**Simple program by using scanf and printf.

UNIT - II: CONTROL STRUCTURES AND FUNCTIONS

Arrays Variables - Assigning Data for Array - One, Two and Multi-dimensional Array - Conditional control statement: if, else, nested if, switch case - Looping statement: while, do while, for, nested for- break - continue and Unconditional control statement: goto statement.

Function declaration - argument - Call the function - Return statement - Type of functions - Recursive functions - Passing Array to functions - Automatic, Static, Register and External storage. ***Example Programmes:** Simple interest calculation, Average of marks and grades, Sum of series.

UNIT - III: STRUCTURE AND UNIONS

Defining a structure - Declaring structure variables - Accessing structure members - Structure initialization - Copying and comparing structure variables - Operations on individual members - Array of structures - Structure within structures - Structures and functions - Unions - Size of structures. ***Example Programmes:** Largest of 'n' numbers and its position, ascending order, Addition and Subtraction of 2 matrices, Factorial calculation

UNIT - IV: POINTERS AND FILES

Understanding pointers - Accessing the address of a variable - Declaring pointer variables - Initialization of pointer variables - Accessing a variable through its pointer - Pointer expressions

Defining and opening of a file - Closing a file - Input/output operation in files - Error handling during I/O operations - Random access to files - Command line arguments. ***Example Programmes:** Command line arguments, opening and closing of file, copying the contents of one file to another, merge of two files.

UNIT - V: PHYSICS APPLICATION PROGRAMS

Quadratic equations - Matrix multiplication - Conversion of temperature from C to F and F to C - Determination of G by Boy's Method - Young's Modulus - Uniform bending - Non-uniform bending - Spectrometer - Refractive index & Dispersive power of prism - Newton's Rings: Radius of curvature - ***Determination of Velocity of light: Foucault's Rotating Mirror Method -Kerr cell method** - Houston's method-Estimation of Average Global Solar Radiation.

Book for study

E. Karthikeyan, *A textbook on C, Publication*: Prince–Hall of India Pvt, Ltd, New Delhi, 1st edition, 2008.

Book for reference

1. E. Balagurusamy, *Programming in ANSI C*, Tata McGraw Hill Publishing, Company Limited, 8th Edition, 2019.
2. Yeshavant Kanitkar, *Let us C*, BPB publications, 15th Edition, 2016.

E-Resources

1. http://ocw.mit.edu/courses/#physics

2. http://hyperphysics.phy-astr.gsu.edu
3. https://www.coursera.org
4. https://nptel.ac.in/courses/115/102/115102014/
5. https://kodlogs.com/166275/difference-between-structure-in-c-and-c
6. https://www.programiz.com/c-programming/c-file-input-output

Course Title	Elective 1: Alternate Energy Resources	**Course Code**	20UPH6EA1
Year	III	**Semester**	VI
Hours/week	4	**Credits**	4

COURSE OBJECTIVES

- acquire an overall insight on the different parameters in solar radiation
- familiarize heat transfer and energy storage mechanism
- understand the working of solar collectors, solar devices, wind mills and other energy conversion devices.
- know about Biomass and gasifiers.

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	identify types of solar radiation and measuring instruments	K1
CO2	understand the working of biogas plants and wind mills	K2
CO3	Design and implement solar PV voltaic systems, solar pumbing and different solar thermal devices	K3
CO4	analyses and develop energy balance equations	K4
CO5	categorize different energy storage systems and indirect sources of solar energy	K1, K4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M		S	S	M	M	M
CO2	S	S	M	M	M		M	M	S	S	S
CO3	M	M	S	S	S		M	S	S	S	S
CO4	M	M	S	S	S		M	S	S	S	S
CO5	S	S	M	S	M		S	S	M	S	M

S - Strong; M - Medium; L - Low

Unit - I: ENERGY AND RADIATION MEASUREMENT

World Energy Futures - Energy Sources and their availability - Renewable Energy Sources -

Prospects of Renewable energy sources - Solar Constant - Solar Radiation at the Earth's surface - solar radiation Geometry - ***Solar radiation measurements** - Estimation of average solar radiation - Solar radiation on tilted surface.

Unit - II: HEAT TRANSFER PRINCIPLE AND SOLAR COLLECTORS

Conduction - Convection-Radiation – Reflectivity – Transmissivity - Transmittance Absorptance product - Physical Principles of the Conversion of Solar radiation into Heat - Flat Plate Liquid Collectors - Transmissivity of cover system - Energy Balance Equation and Collector Efficiency - Thermal performance of FPC - Solar Air Heater and their applications - Concentrating Collector - ***Performance analysis of a Cylindrical Parabolic Concentrating Collectors.**

Unit - III: APPLICATIONS OF SOLAR ENERGY

Solar Water Heating - Solar Thermal Electric Conversion - Solar Photovoltaics - Types of solar cells - Solar Distillation - Solar Pumping - Solar Furnace - Solar Cooking - Solar Energy Storage Systems - Solar Ponds - ***Types of Solar Ponds.**

Unit - IV: BIOMASS AND WIND ENERGY

Bio Mass conversion Technologies-Bio Gas generation-Factors Affecting Bio – Digestion-Classification of Biogas Plants-Types of Biogas Plants- Materials used for Biogas Generation-Basic principles of wind energy conversion-Basic components of wind energy conversion system-Classification of WEC System-***Wind energy collectors**-Performance of wind Machines.

Unit - V: ENERGY STORAGE AND INDIRECT SOURCES OF SOLAR ENERGY CONVERSION

Solar Energy Storage Systems-Chemical Storage-Thermal Storage-Electrical Storage- Geothermal energy- Nature of Geothermal Fields-Geothermal Sources-Hydrothermal Resources- Material Selection for Geothermal Power Plants - Geothermal explanation -***Ocean Thermal Electric Conversion.**

Book for study

G.D. Rai, *Non-Conventional Energy Sources*, Khanna Publishers, 1st Edition, 1988, Reprint 2004.

Books for reference

1. G.D Rai, *Solar Energy Utilization*, Khanna Publishers, 1995.
2. S.P.Sukatme, Solar Energy- Principle of thermal collection and storage, Tata Mc Graw Hill Company, 2006.

E-Resources

1. http://ocw.mit.edu/courses/#physics
2. http://hyperphysics.phy-astr.gsu.edu
3. https://www.coursera.org
4. https://nptel.ac.in/courses/115/102/115102014/
5. https://personal.ems.psu.edu/~radovic/Chapter17.pdf

Course Title	Core Practical – 5: Advanced Experiments	**Course Code**	
Year	III	**Semester**	VI
Hours/week	3	**Credits**	3

COURSE OBJECTIVES

This course offers the students to

- determine the elastic moduli of different material and wires.
- study the wavelength of given source of light and spectrum produced by optical devices.
- improve the skill in the determination of optical, electrical and thermal parameters using appropriate instruments.

COURSE OUTCOMES (CO)

At the end of the course, the students will be able to

CO1	Determine some optical constants and values of solar spectra using spectrometer	K3
CO2	Measure précised values of electrical device through Ballistic galvanometer	K3
CO3	Construct and study the performance of oscillatory circuits	K3, K4
CO4	Measure mechanical values through optical means	K3
CO5	analyze physical parameters using laser equipment	K3, K4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	S	S		S	M	S	S	S
CO2	S	S	S	S	M		M	M	S	S	S
CO3	S	S	M	S	S		S	M	S	S	S
CO4	M	M	S	S	S		M	S	S	S	S
CO5	S	M	M	S	S		S	M	S	S	S

S - Strong; M - Medium; L - Low

Any fifteen of the following experiments:

1. Spectrometer – i -i' curve
2. Spectrometer – Cauchy's constant
3. Spectrometer - Hartmann's formula
4. Spectrometer - Solar spectrum
5. Newton's Rings - Refractive Index of Liquid
6. Ballistic Galvanometer – Figure of merit
7. Potentiometer – High range voltmeter

8. Self inductance of coil – Anderson's bridge
9. Hartley oscillator
10. Colpitt's oscillator
11. FET characteristics
12. UJT Characteristics
13. Band gap energy of the semiconductor
14. Young's modulus - uniform bending (Optic lever)
15. Young's modulus – non-uniform bending (Optic lever)
16. Laser Diffraction – Determination of wave length of the diode laser
17. Resolving power of a lens using He-Ne laser
18. Verification of Malus law using diode laser

Books for reference

1. C. L. Arora, *Practical Physics*, S.Chand& Co., 2009.
2. R. K. Shukla and Anchal Srivastava, *Practical Physics*, New Age International Publishers, 1st edition, 2013.
3. D. Chattopadhyay and R.C. Rakshit, *An Advanced Course in Practical Physics*, New Central Book Agency, 10th edition, 2011.

Pedagogy

Chalk and talk, PPT, Equipment demonstration, Skill Innovative Task, Interaction

Course Title	Core Practical – 6: Microprocessor and C - Programming in Physics	**Course Code**	
Year	III	**Semester**	VI
Hours/week	3	**Credits**	3

COURSE OBJECTIVES

This course offers the students to

- practical knowledge of Microprocessor
- to familiarize the instruction format and instruction set used in microprocessor kit
- to develop the programming skill in microprocessor
- basic functions of C programming
- features of C Programs and how they may applied through physics.

COURSE OUTCOMES (CO)

At the end of the course, the students will be able to

CO1	Understand working and handling of various sections in microprocessor unit , basic programming techniques involved in assembly level and C programming	K2
CO2	Write and execute ALP for specific problems through the microprocessor kit	K3
CO3	Develop application oriented programs and to run in microprocessor	K3
CO4	write the programmes in C language and can execute using computers	K3
CO5	develop the C Programs for formulae used in physics and can analyze the results related to various parameters involved.	K3,K4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

MAPPING

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	M		S	M	S	S	S
CO2	M	S	S	S	M		M	M	S	S	S
CO3	M	S	S	S	S		M	S	S	S	S
CO4	S	S	M	S	S		M	S	S	S	S
CO5	S	S	M	S	S		M	M	S	S	S

S - Strong; M - Medium; L - Low

Any Fifteen of the following experiments:

MICROPROCESSOR PROGRAMMING

1. Program to transfer data between memories
2. Program to find the 1's and 2's complement of 8 - bit data
3. Program to perform 8 – Bit Addition and Subtraction
4. Program to perform 8 –Bit Ascending order

5. Program to perform 8 –Bit Descending order
6. Program to perform 8 –Bit Multiplication
7. Program to perform 16 Bit Addition
8. Program to convert Binary to Gray and Gray to Binary
9. Program to find the smallest and largest in a data Array

C - PROGRAMMING

10. Determine the Square root of the Quadratic equations
11. Matrix multiplication of a given 2 x 2 matrices
12. Conversion of temperature from ^{0}C to ^{0}F and ^{0}F to ^{0}C
13. Determination of 'G' by Boy's Method
14. Young's Modulus - Uniform bending
15. Spectrometer - Refractive index & Dispersive power of prism
16. Newton's Rings - Radius of curvature
17. Determination of Velocity of light - Foucault's Rotating Mirror Method
18. Estimation of Average Global Solar Radiation

Books for reference

1. E. Balagurusamy, *Programming in ANSI C*, Tata McGraw Hill Publishing, Company Limited, 8th Edition, 2019.
2. Yeshavant Kanitkar, *Let us C*, BPB publications, 15th Edition, 2016.

Pedagogy

Chalk and talk, PPT, Programme and Microprocessor Kit demonstration, Skill Innovative Task, Interaction

Programme	I B.Sc. Mathematics & II B.Sc. Chemistry	**Type**	Allied 1
Course Title	Allied Physics - I	**Course Code**	20UMA1AL1/ 20UCH3AL3
Year	I/II	**Semester**	I/III
Hours/week	4	**Credits**	4

COURSE OBJECTIVES

To familiarize the students to

- acquire knowledge on mechanical properties of materials
- understand the thermodynamic laws.
- assimilate the essentials of special theory of relativity.
- understand the principle and theories of optics
- know the concepts of electricity and magnetism.

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	acquire knowledge on gravitation, thermodynamics, relativity, optics and electricity and magnetism	K1
CO2	understand various laws of thermodynamics, working of thermal devices, liquefaction of gases and superconductivity	K2
CO3	know the importance of special and general theory of relativity	K1, K2
CO4	calculate the wavelength of light, specific rotation and angular width	K3, K4
CO5	handle the sensitive galvanometers and magnetometers	K3

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	M		S	S	M	M	M
CO2	M	S	S	M	M		M	S	M	M	M
CO3	S	S	M	S	L		S	S	S	S	M
CO4	M	M	S	S	M		S	M	S	S	S
CO5	M	M	M	S	M		M	S	S	M	S

S - Strong; M - Medium; L - Low

UNIT - GRAVITATION AND ELASTICITY

Kepler's law of planetary motion - Laws of gravitation - Determination of 'G' by Boy's method - Potential and field due to a solid sphere - Variation of 'g' due to altitude and depth - Determination of 'g' by compound pendulum - Poisson's ratio - Twisting couple on a cylinder - Bending moment - Determination of 'Young's modulus by non-uniform bending - Torsional oscillations - use of Torsional Pendulum to determine 'rigidity modulus' and 'moment of inertia' - ***Relation between elastic constants.**

UNIT - II: THERMODYNAMICS

***Laws of thermodynamics I and II-** Derivation of gas laws - Avagadro's hypothesis - Graham's law of diffusion of gases - degrees of freedom - ***viscosity of gases - *thermal conductivity of gases** - Joule Thomson effect - Adiabatic demagnetization - Liquefaction of Helium-Black body radiation - Planks radiation law-thermal conductivity- Meissner effect - Properties of Liquid Helium I and II - Super conductivity - Measurement of Radiation from SUN - Pyroheliometer.

UNIT - III: RELATIVITY

Theory of relativity: Frame of reference - inertial frames - Galilean transformation equations - Michelson Morley experiment - Postulates of Special Theory of Relativity - Lorentz transformation - Time dilation and length contraction - Addition of Velocities - Variation of mass with velocity - ***Mass Energy relation.**

UNIT - IV: OPTICS

Coherent sources - theory of interference fringes - Fresnel Biprism: Experimental arrangement - determination of wavelength of light - interference fringes with white light using a Biprism - Interference due to Reflected light - Lloyd's single-mirror - Determination of refractive index of a liquid - Fresnel and Fraunhofer diffraction - Plane diffraction grating - Determination of wavelength -Dispersive power of a grating - ***Plane of Polarization** - Double refraction - Production and analysis of elliptically and circularly polarized light - ***Optical activity** - Half shade polarimeter.

UNIT - V: MAGNETISM AND ELECTRICITY

Ampere's circuital law - Magnetic flux -Field along the axis of along solenoid - tangent Galvanometer - Moving coil galvanometer-Ballistic galvanometers- Current and charge sensitiveness- Vibration magnetometers-determination of M and H-Self-induction - Mutual induction - Experimental determination - Alternating current - LR and LCR series, circuits - Impedance and Resonance -***Quality Factor-*Band Width.**

Books for study

1. Brijlal and N. Subrahmanyam, *Properties of Matter*, Eurasia Publishing House Private Ltd., New Delhi, 5th Edition, 2002.
2. Brijlal and Subramanyam, *Heat and Thermodynamics and Statistical Physics*, S. Chand & Company, 16th Edition, Reprint 2018.
3. R.Murugeshan and Kiruthiga sivaprasath, *Modern Physics*, S. Chand & Company Private Ltd., New Delhi, 18th Edition, 2019.
4. Brijlal and Subramaniam, *Electricity and Magnetism*, Ratan Prakashan Mandir, New Delhi, 6th Edition 2000.

Books for reference

1. Beiser A, *Concepts of Modern Physics*, Tata Mc Graw-hill publishing company Ltd. New Delhi, 1st Edition, 2010.
2. Gupta A.B., *Modern Optics*, Arunabha Sen books& Allied Private Ltd., Kolkata, 2nd Edition, 2010.
3. Saxena A.K and C.M. Tiwari, *Heat and Thermodynamics*, Narosa Publishing House Private Ltd., New Delhi, 1st Edition, 2014.

E-Resources

1. http://hyperphysics.phy-astr.gsu.edu
2. https://www.coursera.org
3. https://nptel.ac.in/courses/115/102/115102014/

Programme	I B.Sc. Mathematics & II B.Sc. Chemistry	**Type**	Allied 2
Course Title	Allied Physics - II	**Course Code**	20UMA2AL2/ 20UCH4AL4
Year	I/II	**Semester**	II/IV
Hours/week	4	**Credits**	4

COURSE OBJECTIVES

To enable the students

- understand about different atomic models and theories.
- know the facts on nuclear forces and properties of nucleons.
- assimilate the behavior of matter waves and importance of quantum mechanics
- acquire knowledge on the functions and characteristics of transistors and logic circuits.

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	acquaint with different atomic models	K1
CO2	elucidate various theories, models, energy, expression associated with nucleus and nuclear forces	K2
CO3	explain the principle of quantum physics and behavior of matter waves	K2,K3
CO4	comprehend the working of various modes of transistors and simple circuits	K1, k2
CO5	Work with the basic digital circuits using logic gates and design logic circuits by employing Boolean algebra and Karnaugh maps	K3, k4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	S	S		S	S	M	S	M
CO2	S	M	M	S	M		S	S	M	M	M
CO3	S	M	S	S	M		S	M	M	M	M
CO4	S	S	M	S	M		S	M	M	S	M
CO5	S	S	S	S	S		S	M	S	S	M

S - Strong; M - Medium; L - Low

UNIT -I: ATOMIC STRUCTURE

Thomson's plum pudding model - Rutherford's experiment on α-particle scattering - Rutherford's nuclear atomic model: Distance of closest approach - major deficiencies in Rutherford's nuclear model - Bohr's atomic model: Calculations concerning Bohr's atomic model - spectral series of hydrogen atom - deficiencies in Bohr's theory - Sommerfeld's relativistic model - ***Pauli's exclusion principle.**

UNIT -II: ATOMIC NUCLEUS

Theories of nuclear composition: Proton-neutron theory of nuclear composition - general properties of a nucleus -***Packing fraction** - mass defect and atomic binding - accurate expression for mass defect - variation of binding energy - significance of average binding energy - nuclear forces - meson theory of nuclear forces - Nuclear models: Liquid-drop model - nuclear shell model.

UNIT - III: QUANTUM PHYSICS

Waves and particle duality of matter: De Broglie's matter waves - De Broglie's electron waves - Properties of matter waves - Particle nature of X-rays - Experimental study of matter waves -The Davisson-Germer experiment -***Electron microscope** - Heisenberg's principle of indeterminacy - Physical significance of wave function – Eigen values and Eigen functions - Time independent Schrödinger equation - Rigid rotator

UNIT - IV: TRANSISTORS

Transistor action: Transistor connections: Common base connection - Characteristics of common base connection - Common emitter connection - Measurement of leakage current - Characteristics of common emitter connection - Common collector connection - ***Comparison of transistor connections -** Transistor circuit as an amplifier (CE arrangement)- RC and Transformer Coupled two stage amplifier.

UNIT - V: LOGIC GATES

Definitions for digital signals: Digital waveforms - digital logic - The basic gates: NOT, OR and AND gates - Universal logic gates: NOR and NAND gates - AND-OR-INVERT gates - Positive and negative logic - Boolean laws and theorems: Sum-of-products method -truth table to Karnaugh map - pairs, quads and octets - Karnaugh simplifications - ***Don't-care conditions – product-of-sums method - product-of-sums simplification.**

Books for study

1. Theraja B. L., *Modern Physics*, S. Chand & Company, New Delhi, 1st Edition, 2002.
2. Metha V. K. and R. Metha, *Principles of Electronics*, S.Chand& Company, New Delhi, 11th Edition, 2015.
3. Leach D.P., A.P. Malvino and S. Goutam, *Digital Principles and Applications*, Tata McGraw-Hill Book Company, New Delhi, 7th Edition, 2011.

Books for reference

1. Beiser A., *Concepts of Modern Physics*, Tata McGraw Hill Publishing Company Ltd., New Delhi, 6th Edition, 2012.
2. Bell D.A., *Electronic Devices and Circuits*, Oxford University Press, Oxford, 5thEdition, 2009.
3. Floyd T. L. and R.P. Jain, *Digital Fundamentals*, Pearson Education Inc., New Delhi, 1st Edition, 2006.

E-Resources

1. http://ocw.mit.edu/courses/#physics
2. http://hyperphysics.phy-astr.gsu.edu
3. https://www.coursera.org
4. https://nptel.ac.in/courses/115/102/115102014/
5. https://study.com/academy/lesson/atomic-nucleus-definition-structure-size.html

Programme	B.Sc. Chemistry	**Type**	NME 1
Course Title	Instrumental Methods for Chemical Analysis	**Course Code**	20UCH3NM1
Year	II	**Semester**	III
Hours/week	2	**Credits**	2

COURSE OBJECTIVES

The objective of this paper is to make the students know about

- working of UV and IR spectrometers
- components of Raman and NMR spectroscopy
- various types of spectrophotometers

COURSE OUTCOMES (CO)

By the end of the course, the students will be able to

CO1	Understand the basic theories of advanced research instrumentation techniques.	K2
CO2	Identify Raman and NMR Spectra.	K1
CO3	distinguish Fluorescence and Phosphorescence	K2
CO4	Classify various types of spectrophotometers	K3
CO5	Gain the knowledge of spectrophotometers	K2

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S		S	S	S	S	S
CO2	S	S	S	S	M		S	S	S	M	M
CO3	S	S	S	S	M		S	M	M	S	M
CO4	S	S	S	S	M		S	S	S	S	M
CO5	S	S	S	S	S		S	S	S	S	S

S - Strong; M - Medium; L - Low

UNIT - I: UV AND IR SPECTROMETERS

Radiation sources - Monochromators - Detectors - Double beam spectrophotometer.

Infrared Spectrophotometer: The range of IR radiation - Instrumentation - Radiation sources - Monochromators - Single beam and Double beam Spectrophotometer.

UNIT - II: RAMAN AND NMR SPECTROSCOPY

Raman: Characteristics and properties of Raman lines - Difference between Raman spectra & IR spectra - Instrumentation - Source of light - Filters - Sample holders - Spectrograph.

Nuclear Magnetic Resonance: Instrumentation - Sample holder - Magnet - Sweep generator - RF generator - RF receiver - Limitations

UNIT -III: SPECTROPHOTOMETRY

Fluorescence and Phosphorescence - Theory - Singlet and Triplet states - Instrumentation - Single beam and Double beam Fluorimeters - Spectrofluorimeters - Instruments for Phosphorimetric analysis - Comparison of Fluorimetry and Phosphorimetry.

Book for study

Gurdeep Chatwal and Anand, *Instrumental Methods and Analysis*, Himalaya Publishing House, Mumbai, , 1st Edition, Reprint 2016.

Book for reference

B.K.Sharma, *Instrumental Methods of Chemical analysis*, Krishna Prakashan Media Publishing House, Meerut, Revised Edition: 3rd, 2014.

E-Resources

1. https://byjus.com/chemistry/spectroscopy
2. https://en.wikipedia.org/wiki/Raman_spectroscopy

Programme	B.Sc., / B.A., / B.Com.,	**Type**	NME 2
Course Title	Energy Auditing	**Course Code**	20UPH4NM2
Year	II	**Semester**	IV
Hours/week	2	**Credits**	2

COURSE OBJECTIVES

To enable the learners to

- understand the energy crisis and environmental concerns associated with the energy management
- familiarize about energy auditing tools & systems and their essential elements
- acquire the knowledge and the basic skills for energy monitoring and energy auditing

UNIT - I: ENERGY

Energy resources - Different forms of energy - New and renewable energy - Primary and secondary energy - Conventional and non-conventional energy - Energy conservation and its importance - Energy and environmental concerns - Energy scenario and energy crisis.

UNIT - II: ENERGY AUDIT & MANAGEMENT

General philosophy - Need of energy audit and management - Definition and objective of energy audit - Types of energy audits - Preliminary & Detailed energy audit methodology Industrial, commercial and residential audit planning - General principles of energy management - Energy management strategy - Energy audit instruments

UNIT - III: ENERGY CONSERVATION

Energy conservation in domestic and industrial sectors - Energy conservation in Thermal system,

Electrical system and Lighting system.

Books for study

1. Albert Thumann and Willaim J. Younge, Hand book of energy audits, The Fairmont Press, Inc., 7th Edition, 2007.
1. W.C. Turner, Energy management hand book, The Fairmont Press Inc., 4th Edition, 2001.

Books for reference

G.D. Rai, Non-conventional energy sources, Khanna Publishers, 4th Edition, 2011.

LEARNING OUTCOMES

Student will acquire skills such as

- energy management, auditing and optimization processes.
- hands on experience and skills to conduct an audit.
- demonstrate skills required for energy management.

E-Resources

https://en.wikipedia.org/wiki/Energy_conservation

Programme	B. Sc Mathematics / B. Sc Chemistry	**Type**	Allied Practical
Course Title	Allied Physics Practical	**Course Code**	
Year	I/II	**Semester**	II/IV
Hours/week	2	**Credits**	2

COURSE OBJECTIVES

This course offers the students to

- verify certain concepts of properties of matter and geometrical optics
- verify output characteristics of certain analog electronic devices and check some of its applications.
- train students in handling instruments independently and measure to precision.

COURSE OUTCOMES (CO)

At the end of the course, the students will be able to

CO1	calibrate the voltmeter and ammeter to know the sensitivity of the device.	K3
CO2	obtain the refractive Index of different transparent materials.	K3
CO3	verify the output characteristics of certain analog electronic devices and check some of its applications.	K3,K4
CO4	construct the circuit and verifying the truth tables of basic logic gates.	K3,K4
CO5	handle instruments independently and measure precisely.	K2,K3

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

MAPPING

	PSO1	PSO2	PSO3	PSO4	PSO5		PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	M		S	M	S	S	S
CO2	M	S	S	S	M		M	M	S	S	S
CO3	M	S	M	S	S		S	M	S	S	S
CO4	S	S	M	S	S		M	S	S	S	S
CO5	S	S	M	S	S		M	S	S	S	S

S - Strong; M - Medium; L - Low

Any Fifteen of the following experiments:

1. Compound pendulum.
2. Young's Modulus – Non uniform bending.
3. Young's modulus – Uniform bending.
4. Spectrometer – Solid prism.
5. Spectrometer – Grating.
6. Potentiometer – Low range ammeter calibration.

7. Potentiometer – Voltmeter calibration.
8. Rigidity modulus - Torsional pendulum.
9. Rigidity modulus – Static torsion.
10. Meter bridge.
11. Deflection magnetometer – Field along the axis of the coil.
12. Newton's rings.
13. Deflection magnetometer – Tan C position.
14. Zener diode – Characteristics.
15. Transistor characteristics – CE mode
16. Verification of truth tables AND, OR and NOT gates.
17. NAND as universal gate.
18. OP- AMP – adder and subtractor.

Books for reference

1. C. L. Arora, *Practical Physics*, S.Chand& Co., 2009.
2. R. K. Shukla and Anchal Srivastava, *Practical Physics*, New Age International Publishers, 1st edition, 2013.
3. D. Chattopadhyay and R.C. Rakshit, *An Advanced Course in Practical Physics*, New Central Book Agency, 10th edition, 2011.

Pedagogy

Chalk and talk, PPT, Equipment demonstration, Skill Innovative Task, Interaction

Programme	B.Sc., /M.Sc.,	**Type**	**VALUE ADDED COURSE**
Course Title	**PHYSICS INSTRUMENTATION SKILLS**	**Course Code**	
Year	I, II and III		
Hours/week	2	**Credits**	2

COURSE OBJECTIVES

The objective of this course is to enable the students

- to handle variety of measuring instruments in physical and mechanical systems.
- to get workshop practice and manufacturing methods
- to import skill in fault finding and rectification of electrical and electronic devices.
- to know about mechanism of gears and power generators

UNIT -I

Introduction: Measuring units. conversion to SI and CGS. Familiarization with meter scale, Verniercalliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc.

UNIT -II

Mechanical Skill: Concept of workshop practice. Overview of manufacturing methods: casting, foundry, machining, forming and welding. Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood.

UNIT- III

Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines. Cutting tools, lubricating oils.Cutting of a metal sheet using blade.Smoothening of cutting edge of sheet using file.Drilling of holes of different diameter in metal sheet and wooden block.Use of bench vice and tools for fitting. Make funnel using metal sheet.

UNIT -IV

Electrical and Electronic Skill: Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay.

UNIT -V

Introduction to prime movers: Mechanism, gear system, wheel, Fixing of gears with motor axel. Lever mechanism, lifting of heavy weight using lever. braking systems, pulleys, working principle of power generation systems. Demonstration of pulley experiment.

LEARNING OUTCOMES

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

- handle various type soft measuring equipment's, foundry - workshop tools, lighting & wiring accessories.
- estimate cost of wiring for house and buildings.
- repair household electrical and electronic appliances.
- demonstrate the working of different mechanical, electrical and electronic devices in every day practice.

For candidates admitted from academic year 2021-22 onwards Under New CBCS

Programme	B.Sc/M. Sc Physics	**Type**	Value Added Course
Course Title	CCTV Installation and Services	**Course Code**	

COURSE OBJECTIVES

- Skills that will help you enter booming security industry and get well paid job. Security is rapidly shifting from old CCTV and Alarm Systems to IP Network based system

COURSE OUTCOMES

- To understand CCTV camera installation requirement in terms of equipment, system, tools, applications appropriate for a particular site.

S.no	CCTV Installation and Services - Syllabus	Modules
1	**CCTV SYSTEM**	Module 1
	What is CCTV System - What is CCD Camera - Type of CCTV Camera - Components of Basic camera - Assembling CCTV Camera - Types of Camera Lens	
2	**PCB of CCD Camera and CCD Description**	Module 2
	PCB Parts - PCB Types - PCB Technology - Function of CCD - Type of CCD - Sizes of CCD - Brands of CCD	
3	**Quality of CCD Camera**	Module 3
	T V L - Resolution - Connection of CCD Camera - Simple Camera Connections - Audio : MIC & Speaker Connection. - LED Night Vision Connections	
4	**Lens and CCTV ACCESSORIES**	Module 4
	Type of Lens - Board Lens - C Mount Lens - Auto Iris Lens - Zoom Lens Cable - Type of Cable - Quality of Cable - Gauge of Cable - Use and application of Cable	
5	**DVR (DIGITAL VIDEO RECORDERS)**	Module 5
	Type of DVR - Frames Configuration of DVR - Internal Setting of DVR - Front and Back Panel of DVR - Wiring Connections of DVR - Types of Storage Device - HDD fixing in DVR - HDD Formatting throw DVR Menu	
6	**CCTV CAMERA Installation**	Module 6
	Testing & Positioning Camera Through Camera Tester-BNC connecter connection, power cable connection - Cable Preparation & Testing - Installation of CCTV camera - Wiring and its connections - Power supply for camera - Connectors - BNC / RCA - Power Connectors - DVR Structure - Front and back panel of DVR	

For candidates admitted from academic year 2021-22 onwards Under New CBCS

Programme B.Sc/M. Sc Physics **Type** Value Added Course

Course Title Mobile Phone Servicing **Course Code**

COURSE OBJECTIVES

- Repair and Diagnose the Problem of all kinds of faults in Mobile Phone handsets in Hardware as well Software and rectify the faults using tools and equipment and various software.

S.no	Mobile Phone Servicing - Syllabus	Modules
1	**Introduction**	Module 1
	Introduction to basic electronics and Architecture - Components of the GSM network - Types of networks in cell phones -Identification of components - study of service providers – Different sections in mobiles phones	
2	**Introduction to Hardware & materials**	Module 2
	Usage of Digital Millimeter - Resistors, Capacitors and coils - Diodes & Transistors, Crystal, ICs & SMD's - Identification of the different parts and functions.	
3	**Study of PF, RF, Filters and Mother Boards**	Module 3
	Fault finding and servicing - Chip Level Soldering & De-soldering - Identification of different types of ICs and their functioning -Key pad LEDs fault finding - Tracing strips problems - Checking of components & circuit board	
4	**Introduction to MMC problems**	Module 4
	Types of problems - Charging, Camera, Display problems - Battery, Hanging and Network problems - Different solutions for different problems - Trouble shooting and problem identification in each sections	
5	**Introduction to Audio Section**	Module 5
	Components of Audio Section -Nomenclature of the Audio components - Study of Mike, its components - Speaker, Vibrator and ringer theory	
6	**Introduction to touch screen and Assembling**	Module 6
	Functioning of Key pad LEDs - Trouble shooting of the touch screen mobiles - Installation of Drivers - Setting of File Section - Flashing of the Cell Phones - Restarting of Dead Cell Phones - Trouble Shooting methods	

COURSE OUTCOMES

- Repair and Diagnose the Problem of all kinds of faults in Mobile Phone handsets in Hardware as well Software.