SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN (AUTONOMOUS), CHENNAI - 600044.

Re accredited with A^+ Grade by NAAC

BACHELOR OF SCIENCE

Under the faculty of Science

DEPARTMENT OF PHYSICS

CHOICE BASED CREDIT SYSTEM (CBCS)

OUTCOME BASED EDUCATION (OBE)

(Effective from the Academic Year 2020-21)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The Under graduates of various disciplines would be fully equipped

- To life-long learning in order to become effective collaborators and innovators, leading or participating in ventures that address social, technical and business challenges.
- To transform learners into holistic individuals acquiring higher levels of knowledge and competence.
- To approach life skills which are inclusive and value-based to appreciate human values and ethics.

PROGRAMME OUTCOMES (POs)

The Undergraduate students of all disciplines will be able to:

- **PO 1**-Develop sharp cognisance of concepts, apply the domain knowledge with utmost confidence and be assertive at any given opportunity.
- **PO 2**-Possess deeper understanding of life skills to appraise life and draw logical conclusions.
- **PO 3**-Design and develop solutions for challenging problems of society.
- **PO 4**-Acquire programme centric thought process facilitating further studies in the respective domain.
- **PO 5**-Engage in life-long learning to easily adapt to the dynamic environment and obtain clarity and preparedness for field specialisation
- **PO 6**-Self-actualise and self-regulate, focussing on ethical and moral values to become a compassionate human being.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

- PSO1: To acquire knowledge in the contemporary areas of Physics
- PSO2: Able to design / perform experiments in the laboratory to demonstrate the concepts, Principles and theories learned in the classroom
- PSO3: To apply the knowledge acquired in the classroom and laboratory to solve specific problems in theoretical and experimental physics
- PSO4: Able to employ critical thinking in the analysis of problems in the basic areas of physics
- PSO5: Gain admission in higher education in the core/interdisciplinary/ multidisciplinary areas

COURSE FRAME WORK

SEMESTER I

SEM	COURSE CODE	COURSE TITLE	TITLE OF THE PAPER	HRS	CREDITS	CA	SE	T
I	20ULTFC1001	LANGUAGE	Tamil I/Hindi I/Sanskrit I	5	3	40	60	100
	20UGEFC1001	ENGLISH	English I	5	3	40	60	100
	20UPHCT1001	CORE MAJOR I	Properties of Matter	5	3	40	60	100
	20UPHCT1002	CORE MAJOR II	Thermal physics	4	3	40	60	100
	20UPHAT1001	ALLIED I	Allied Chemistry I	4	4	40	60	100
		SOFT SKILLS	Essentials of Communication Skills		3	50		50
		SOFT SKILLS	Environmental Studies		2	50		50

SEMESTER II

SEM	COURSE CODE	COURSE TITLE	TITLE OF THE PAPER	HRS	CREDITS	CA	SE	Tot
II	20ULTFC2002	LANGUAGE	Tamil I/Hindi I/Sanskrit II	5	3	40	60	100
	20UGEFC2002	ENGLISH	English II	5	3	40	60	100
	20UPHCT2003	CORE MAJOR III	Acoustics and thermodynamics	5	3	40	60	100
	20UPHCT2004	CORE MAJOR IV	Mechanics	4	3	40	60	100
	20UPHCP2001	CORE MAJOR PRACTICAL I	Practicals I	3	2	20	30	50
	20UPHAT2002	ALLIED II	Allied Chemistry II	4	4	40	60	100
	20UPHAP2001	ALLIED PRACTICAL I	Allied Chemistry Practical	2	2	20	30	50
		SOFT SKILLS	Essentials of Spoken and Presentation Skills		3	50		50
		SOFT SKILLS	Yoga		2	50		50

SEMESTER III

SEM	COURSE CODE	COURSE TITLE	TITLE OF THE PAPER	HRS	CREDITS	CA	SE	Tot
III	20ULTFC3003	LANGUAGE	TAMIL I/HINDI I/SANSKRIT IIII	5	3	40	60	100
	20UGEFC3003	ENGLISH	ENGLISH II	5	3	40	60	100
	20UPHCT3005	CORE MAJOR V	Mathematical Physics & Statistical Mechanics	5	4	40	60	100
	20UPHCT3006	CORE MAJOR VI	Optics and Spectroscopy	4	4	40	60	100
	20UPHAT3MA3	ALLIED III	Allied mathematics I	4	5	40	60	100
		NME	Non major elective		3	50	-	100

SEMESTER IV

SEM	COURSE CODE	COURSE TITLE	TITLE OF THE PAPER	HRS	CREDITS	CA	SE	Tot
IV	20ULTFC4004	LANGUAGE	Tamil I/Hindi I/Sanskrit II	5	3	40	60	100
	20UGEFC4004	ENGLISH	English II	5	3	40	60	100
	20UPHCT4007	CORE MAJOR VII	Atomic Physics	5	4	40	60	100
	20UPHCT4008	CORE MAJOR VIII	Electricity and Magnetism	4	4	40	60	100
	20UPHAT4MA4	ALLIED III	Allied mathematics II	4	5	40	60	100
	20UPHCP4002	CORE MAJOR PRACTICAL II	Practicals II	3	2	20	30	50
		NME	Non major elective		3	50	-	100

SEMESTER V

SEM	COURSE CODE	COURSE TITLE	TITLE OF THE PAPER	HRS	CREDITS	CA	SE	Tot
V	20UPHCT5009	CORE MAJOR IX	Electromagnetism	5	4	40	60	100
	20UPHCT5010	CORE MAJOR X	Basics of Nanoscience	5	4	40	60	100
	20UPHCT5011	CORE MAJOR XI	Nuclear physics	4	4	40	60	100
	20UPHCE5001	CORE ELECTIVE I	Microprocessor 8085	5	5	40	60	100
	20UPHER5001	CORE ELECTIVE II	Research based project	5	5	40	60	100
			Skill Enhancement course		3	50		

SEMESTER VI

SEM	COURSE CODE	COURSE TITLE	TITLE OF THE PAPER	HRS	CREDITS	CA	SE	Tot
VI	20UPHCT6012	CORE MAJOR XII	Relativity and Quantum Mechanics	7	4	40	60	100
	20UPHCT6013	CORE MAJOR XIII	Solid State Physics	7	4	40	60	100
	20UPHCT6014	CORE MAJOR XIV	Integrated Electronics	7	4	40	60	100
	20UPHCP6003	CORE MAJOR PRACTICAL III	Practicals III - General	3	2	40	60	100
	20UPHCP6004	CORE MAJOR PRACTICAL IV	Practicals IV - Electronics	3	2	40	60	100
	20UPHEP6001	CORE ELECTIVE PRACTICAL	Elective practical- Microprocessor	3	5	40	60	100
		Skill based Elective	SWAYAM – MOOC		3	50		

SYLLABUS

I YEAR — MAJOR

I & II SEMESTER

CORE PAPER I-SEMESTER-I

PROPERTIES OF MATTER

Subject code: 20UPHCT1001 Total hours: 5
L-T-P: 5-0-0 Credit: 3

COURSE OBJECTIVES:

1. To understand the laws of gravitation.
2. To identify the characteristics of solids and fluids in terms of their properties.
3. The basic concepts related to modulus of elasticity
4. Explain certain properties of water using the concepts of cohesive forces and surface tension.

COURSE OUTCOME:

CO. No	CO Statement
CO1	Explain the concept of dynamics and gravitation
CO2	Analyse the elastic behaviour and working of torsional pendulum
CO3	Study of bending behaviour beams and analyse the expression for young's modulus
CO4	Apply the knowledge of surface tension and viscosity of fluid in practical's
CO5	In laboratory the student utilizes the theoretical knowledge to perform experiments related to properties of matter

UNIT 1: GRAVITY AND GRAVITATION **15 hrs**

Motion of falling bodies- Kepler's law of planetary motion (statement only) - Determination of G by Cavendish method-Boy's method- merits of Boy's method over Cavendish method. Gravitational field (definition only) - Gravitational potential (definition only)- Gravitational potential and field due to a uniform solid sphere and hollow sphere. Applications.

UNIT 2: ELASTICITY **15 hrs**

Elasticity: Basic definitions Stress, strain, Hooke's law, Poisson's Ratio, Modulus of elasticity. Relation between elastic moduli. Bending of beams - Beam - Bending moment- Neutral axis - Expression for bending moment - Theory of Uniform and Non uniform

bending - Determination of Young's modulus by uniform bending and Non uniform bending- Experiment to determine Young's modulus by Koenig's method.

UNIT 3: TORSION **15 hrs**

Torsion of a body: Torsion of a cylinder - Expression for torque per unit twist - Determination of Rigidity modulus by static torsion (scale and telescope method) - Work done in twisting a wire -Torsional oscillation of a body - Rigidity modulus by torsion pendulum (Dynamic method).

UNIT 4: SURFACE TENSION **15 hrs**

Definition and its dimensional formula - Excess pressure inside a curved liquid surface - Application to spherical and cylindrical drops and bubbles - Determination of surface tension of a liquid by - Jaeger's method and drop weight method. Quincke's method - Determination of angle of contact and experiment. Variation of surface tension with temperature and its experimental study.

UNIT 5: VISCOSITY **15 hrs**

Viscosity and its dimensional formula - Poiseuille's formula for the flow of liquid through a capillary tube - Corrections to Poiseuille's formula - Experiment to determine Co-efficient of viscosity of a liquid by Variable pressure head by Poiseuille's method - Ostwald's Viscometer - Variation of viscosity of a liquid with temperature and pressure - Applications of viscosity - Friction and Lubrication.

BOOKS FOR STUDY:

1. R.Murugesan, (2018), Properties of Matter, S.Chand & Co. Pvt. Ltd., Ram Nagar, New Delhi.
2. Brij Lal and N. Subrahmanyam, (2005), Properties of Matter, S.Chand & Co. Pvt. Ltd., New Delhi.
3. C.L.Arora, P.S.Hemne, (2010), Physics for Degree Students, S.Chand & Co. Pvt. Ltd., New Delhi

BOOKS FOR REFERENCE:

1. Hafez A. Radi, John O Rasmussen (2013), Principles of Physics: For Scientists and Engineers, Springer Heidelberg, New York - Dordrecht – London.
2. A Treatise on General Properties of Matter, New Central Books agency (p) Ltd, Calcutta.

3. Chatterjee and Sen Gupta, (2001). Elements of Properties of Matter, D.S.Mathur, (2008), Shyam Lal Charitable Trust, New Delhi.
4. D. Hallidary, Resnick and J Walker, 2001, Fundamental of Physics, 6th Edition, Wiley, New York.

E-LEARNING RESOURCES:

1. https://pressbooks.bccampus.ca/universityphysicssandbox/chapter/newtons-law-of universal -gravitation/
2. https://www.dictionary.com/browse/gravitation
3. https://www.bu.edu/moss/mechanics-of-materials-torsion/
4. https://physics.info/viscosity/
5. http://hyperphysics.phy-astr.gsu.edu/hbase/surten.html

Mapping of CO with PSO:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	M	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S
Average	S	S	S	S	S

PEDAGOGY: Chalk and talk, PPT, Lectures, Group discussions and seminars.

CORE PAPER II-SEMESTER-I

THERMAL PHYSICS

Subject code: 20UPHCT1002 Total hours: 4
L-T-P: 4-0-0 Credit: 3

COURSE OBJECTIVES:

1. To understand the fundamental principles of thermal physics
2. To explain and compute the values of probability, ensembles and entropy
3. To acquire the knowledge of conduction, convection, radiation, diffusion and thermal conductivity

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Learn the basic concepts of heat capacity, conductivity and radiation effects and explains about how they are assessed for different outlines of practical relevance
CO2	Study the fundamental concepts of thermal and radiation effects in physics and understanding the significance of terms like Dulong and Petit's law, Planck's law, Wien's law etc.,
CO3	Applying the concepts in order to understand the specific heat capacities by the method of mixtures and study in detail about the Reversible and irreversible process and also working of a Carnot engine, and knowledge of calculating change in entropy for various process
CO4	Acquainted with various conduction and diffusion process thereby learning how energy is distributed in radiation using various experiments
CO5	Finally gained peripheral ideas about thermal physics and their applications.

UNIT I: THERMOMETRY **15 hrs**

Types of thermometers - Platinum resistance thermometer – Construction – Working – Callender and Griffith's bridge – Advantages – Disadvantages – Thermistor – Construction – Resistance – temperature characteristics of thermistors – Measurement of temperature.

UNIT II: CALORIMETRY **15 hrs**

Specific heat capacity – Specific heat capacity of solids – Statement and derivation of Dulong and Petits law – Calorimeter – Method of mixtures – Barton's correction – Specific heat capacity of liquid – Experimental determination – Specific heat capacity of gases – C_p by Regnault's method and Callender and Barne's methods – C_v by Joly's method – Difference between two specific heat capacities – Mayer's relation between C_p & C_v.

UNIT III: LOW TEMPERATURE PHYSICS **15 hrs**

Joule Thomson Effect – Porous plug experiment – Theory of Porous plug experiment - Liquefaction of air – Linde's method – Principles of Adiabatic demagnetization – Glauque's method – practical applications of low temperatures – Refrigeration – Carnot's cycle as refrigerator – Types of refrigerating machines – Electrolux refrigerator – Frigidaire – Air conditioning machines – Effects of CF_2Cl_2 on ozone layer.

UNIT IV: CONDUCTION **15 hrs**

Conduction – Definition of thermal conductivity – Co-efficient of thermal conductivity - Thermal diffusivity – Steady state – Rectilinear flow of heat along a bar – Thermal conductivity of bad conductor – Lee's Disc method.

UNIT V: RADIATION **15 hrs**

Radiation – Black body radiation – Characteristics - Energy distribution in blackbody radiation – Kirchhoff's law – Wein's law – Rayleigh – Jean's law – Derivation of Planck's law – Stefan's law and its verification – Determination of stefan's constant.

BOOKS FOR STUDY:

1. R. Murugesan, 2015, Thermal Physics**,** S. Chand and Publishing.
2. Kiruthiga Sivaprasath and Murugeshan, 2012, Properties of Matter and Acoustics, S. Chand and Publishing.

3. Brij Lal, N. Subrahmanyam and P.S Hemne, 2008, Heat, Thermodynamics and Statistical Physics**,** S. Chand and Publishing.
4. Anandamoy Manna, 2011, Heat and Thermodynamics, Pearson Publishers.
5. Sharma and Sarkar, 2018, Thermodynamics and Statistical Physics, Himalaya Publishing House, 2018.

BOOKS FOR REFERENCE:

1. Stephen J. Blundell and Katherine M. Blundell, 2009, Concepts in Thermal Physics, Oxford University Press, 2009.
2. Ralph Baierlein, 2012, Thermal Physics, Cambridge University Press.
3. Andrew F. Rex, 2017, Thermal Physics, CRC Press, Taylor and Francis Group.

E-LEARNING RESOURCES:

1. https://www.youtube.com/watch?v=l0VGXb4ilxw
2. https://www.slideshare.net/MidoOoz/the-joule-thomson-experiment
3. https://www.youtube.com/watch?v=XrAktUy3_3k
4. https://www.youtube.com/watch?v=iENG9VnBeP0
5. http://home.iitk.ac.in/~gtm/thermodynamics/ui/Course_home-31.htm

Mapping of CO with PSO:

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	M	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	M	M	S	S
CO5	S	S	S	S	S
Average	S	S	S	S	S

PEDAGOGY: Chalk and talk, PPT, Lectures, Group discussions and seminars.

ALLIED PAPER I-SEMESTER-I

ALLIED PHYSICS - I

Subject code: 20UMAAT1D01 Total hours: 4
L-T-P: 4-0-0 Credit: 4

COURSE OBJECTIVES:

1. To understand the concepts of simple harmonic motion, viscosity and surface tension
2. Analyse the behaviour of elastic materials.
3. Understand the principle of potentiometer and apply it to calibrate the voltmeter.

COURSE OUTCOMES:

CO No.	CO Statement
CO 1	Understand the concept of simple harmonic motion and analyse its composition.
CO 2	Acquire the skills to obtain the elastic behaviour of different materials.
CO 3	Identify the different types of viscous force, concepts in surface tension and their role in practical life.
CO 4	Apply the kinetic theory of gases to understand the Vander walls equation and analyse the applications of ultrasonics.
CO 5	Apply the concepts of magnetic effect on current in various applications.

UNIT I: SIMPLE HARMONIC MOTION **15 hrs**

Simple Harmonic Motion – Composition of two Simple harmonic motions in a straight line – Composition of two Simple harmonic motions of Equal time periods at right angles – Lissajous figures – Experimental method for obtaining Lissajous figures – Applications – Free, Damped and forced vibrations – Definitions only – Statement of Fourier theorem.

UNIT II: ELASTICITY **15 hrs**

Basic terms – Hooke's law – Elastic constants – Relation between Elastic constants – Experiment to determine young's modulus by non-uniform bending – Torsion of a wire –

Experiment to determine rigidity modulus by torsional pendulum & static torsion – Applications of elastic behaviour of materials.

UNIT III: VISCOSITY&SURFACE TENSION 15 hrs

Velocity gradient – Coefficient of viscosity – Derivation of Poiseuille's formula – Comparison of viscosities of two liquids – Surface tension – Method of drops – Determination of surface tension and interfacial surface tension – Drop weight method.

UNIT IV: HEAT AND SOUND 15 hrs

Postulates of Kinetic theory of gases – Vanderwaal's equation of state – Derivation of critical constants – Ultrasonics – Production of ultrasonic waves by piezoelectric method – Applications of ultrasonics.

UNIT V: ELECTRICITY AND MAGNETISM 15 hrs

Principle of Potentiometer – Calibration of low range voltmeter using potentiometer – Applications – Magnetic field due to a current carrying conductor – Biot - Savart's law – Field along the axis of a coil.

BOOKS FOR STUDY:

1. R. Murugeshan, 2005, Allied physics I & II, S.Chand & Co pvt. Ltd., New Delhi.
2. R. Murugeshan, 2016, Properties of Matter , S.Chand & Co pvt. Ltd., New Delhi.
3. Brijlal and N. Subrahmanyam, 2005, Properties of matter S.Chand & Co. Pvt. Ltd., New Delhi.

BOOKS FOR REFERENCE:

1. R. Murugeshan, KiruthigaSivaprasath, 2013, Properties of Matter and Acoustics, 3rd Edition, Reprint, S. Chand& Co Ltd.
2. R.Murugeshan, 2017, Electricity and Magnetism, S.Chand & Co. Ltd.
3. D. Halliday, R. Resnick and K.S. Krane, 1994, Physics, 4th Edition, Vols.1, 2, Wiley, NY.

E LEARNING RESOURCES:

1. https://www.youtube.com/watch?v=en87rtuodq8
2. http://hyperphysics.phy-astr.gsu.edu/hbase/surten.html

3. http://www.egyankosh.ac.in/bitstream/123456789/18814/1/Experiment-5.pdf

Mapping of CO with PSO:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	S	M
CO2	S	S	S	S	M
CO3	S	S	S	S	M
CO4	S	M	M	S	M
CO5	S	S	S	S	M
Average	S	S	S	S	M

PEDAGOGY: Chalk and talk, PPT, Lectures, Group discussions and seminars.

CORE PAPER III SEMESTER II

ACOUSTICS AND THERMODYNAMICS

Subject code: 20UPHCT2003 Total hours: 4
L-T-P: 4-0-0 Credit: 3

COURSE OBJECTIVES:

1. To be able to realize the concepts of waves and acoustics
2. Acquaint with general terms in acoustics like intensity, loudness, reverberation etc
3. To acquire the knowledge of heat engines, laws of thermodynamics and entropy

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Study the basic concepts of different types of vibration, simple harmonic motion and various thermodynamic relations
CO2	Familiar with various thermodynamic process and have a clear understanding about reversible and irreversible process and also working of a carnot engine, Maxwell's relations and knowledge of calculating change in entropy for various process.
CO3	Realize the importance of applying the concepts in science, industry and medicine
CO4	Understanding in depth about thermodynamic relations and to learn how ultrasonic waves are produced.
CO5	Realize the importance of general terms in acoustics like harmonic oscillator model, including damped and forced oscillators, intensity, loudness, reverberation etc, and study in detail about detection, properties and uses of ultrasonic waves.

UNIT I: WAVES AND OSCILLATIONS **15 hrs**

Simple Harmonic Motion – Free, Damped and Forced vibrations of a body and its differential equation derivation – Resonance – Statement of Fourier's Theorem – Intensity of sound – Expression for intensity of sound and its measurement – Loudness of sound – Distinction between loudness and intensity of sound

UNIT II: ULTRASONICS **15 hrs**

Introduction – Production of ultrasonic waves – Piezo electric crystal method – Magnetostriction method – Properties – Application of ultrasonics to science, industry and medicine.

UNIT III: THERMODYNAMICS **15 hrs**

Thermodynamic system - Thermodynamic equilibrium – Laws of thermodynamics (Statement only) – Zeroth law of thermodynamic – Application of first law to isothermal and adiabatic process – work done in isothermal and adiabatic process.

UNIT IV: HEAT ENGINES **15 hrs**

Carnot engine – efficiency – Carnot cycle as refrigerator – Practical heat engine – Diesel engine and petrol engine – Derivation for efficiency – Difference between diesel engine and petrol engine.

UNIT V: ENTROPY **15 hrs**

Concept of entropy – Change of entropy in reversible and irreversible process – Temperature – Entropy diagram – Physical significance of entropy – Thermodynamic potentials – Maxwell's thermodynamic relation and its derivation.

BOOKS FOR STUDY:

1. Kiruthiga Sivaprasath and Murugeshan, 2012, Properties of Matter and Acoustics, S. Chand and Publishing.
2. R. Murugesan, 2015, Thermal Physics, S. Chand and Publishing.
3. Brij Lal, N. Subrahmanyam and P.S Hemne, 2008, Heat, Thermodynamics and Statistical Physics, S. Chand and Publishing.
4. D. Jayaraman, K. Ilangovan, S.Viswanathan, 2009, Thermal Physics and Statistical Mechanics, Viswanathan (Publishers and Printers) Pvt. Ltd.
5. Sharma and Sarkar, 2018, Thermodynamics and Statistical Physics, Himalaya Publishing House.

BOOKS FOR REFERENCE:

1. Jean Philippe Anserment, Sylvain D. Brechet, 2019, Principles of Thermodynamics, Cambridge University Press.

2. Lawrence E. Kinsler, Austin R. Frey, Alan B. Coppens, James V. Sanders, 2009, Fundamentals of Acoustics, Wiley India Edition.

3. Claus Borgnakke, Richard E. Sonntag, 2009, Fundamentals of Thermodynamics, Wiley Publishers.

E LEARNING RESOURCES:

1. https://www.youtube.com/watch?v=59OzOOpMcH0
2. https://www.youtube.com/watch?v=YM-uykVfq_E
3. https://www.youtube.com/watch?v=bLTSizDLLTQ
4. https://www.youtube.com/watch?v=F-sOMdfnvxE

Mapping of CO with PSO:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	S	M	S	S
CO3	M	S	S	S	S
CO4	S	S	S	S	M
CO5	S	S	S	S	S
Average	S	S	S	S	S

PEDAGOGY: Chalk and talk, PPT, Lectures, Group discussions and seminars.

CORE PAPER IV SEMESTER II

MECHANICS

Subject code: 20UPHCT2004 Total hours: 5
L-T-P: 5-0-0 Credit: 3

COURSE OBJECTIVES:

1. The students will learn Bifilar and Compound Pendulum and its expression for time period

2. Understand the Expression for centre of gravity and centre of pressure

- To demonstrate knowledge and understanding of the following fundamental concepts in: the dynamics of system of particles,
- motion of rigid body,
- Lagrangian and Hamiltonian formulation of mechanics

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Outline the basic principles and fundamentals of dynamics of rigid bodies and determine the centre of gravity of simple geometric shapes.
CO2	Identify the variation in pressure and determine the centre pressure at a point in liquid.
CO3	Discuss the Lagrangian and Hamiltonian formulations of classical mechanics
CO4	The students will to apply and describe the mechanics of a particle, and the motion of a mechanical system using Lagrange-Hamilton formalism.
CO5	In laboratory, student will identify the experiments related to mechanics (compound pendulum).

UNIT I: RIGID BODY DYNAMICS **15 hrs**

Compound pendulum theory - condition for minimum period - interchangeability of Centre of suspension and Centre of oscillation - g using compound pendulum - Bifilar pendulum - parallel threads.

UNIT II: CENTRE OF GRAVITY AND CENTRE OF PRESSURE 15 hrs

Definition of center of gravity and center of mass - Distinction between C.G and C.M - centre of gravity of a right solid cone - center of gravity of a hollow right circular cone - centre of gravity of a solid hemisphere - centre of gravity of a hollow hemisphere. Centre of pressure definition-centre of pressure of a rectangular lamina- centre of pressure of a triangular lamina.

UNIT III: FLUID MOTION 15 hrs

Bernoulli's theorem (Definition only) - Applications: Torricelli's theorem, Venturimeter and Pitot tube. Low pressure-Production of low pressure vaccum pumps - Backing pumps - High vaccum pumps - rotary pump. Detection of leakage - Single Pirani guage.

UNIT IV: CLASSICAL MECHANICS I 15 Hrs

Basic concepts - Degrees of freedom - Constraints - Holonomic and non - Holonomic constraints - Scleronomics and Rheonomic constraints - Generalised coordinates - transformation equations - Principle of virtual work - D'Alembert's principle - Derivation of Lagrange's equation of motion.

UNIT V: CLASSICAL MECHANICS II 15 Hrs

Phase space - Hamiltonian function H - Hamiltonian equation - Physical significance of H - Applications of Hamilton's equations of motion - Particle in central force field in space - Equation of motion of simple pendulum.

BOOKS FOR STUDY:

1. Murugeshan, R. 2016, Properties of Matter, S.Chand& Co pvt. Ltd.
2. Brij Lal and Subrahmanyam, 2002, Properties of Matter N,S.Chand & Co pvt.Ltd.
3. M.Prabhaharan, 2010, Mechanics and Properties of Matter, SNAMS Book house.
4. H. Goldstein, 2011, Classical Mechanics Addison Wesley Publications.
5. R. Murugeshan, 2008, Mechanics and Mathematical methods, S. Chand & Company Ltd.

BOOKS FOR REFERENCE:

1. D.S. Mathur, 2001, Mechanics , S.Chand& Co, II edition.
2. D. Halliday, R. Resnick and J. Walker, 2001, Fundamentals of Physics, VI edition, Wiley, NY.

3. D. Halliday, R. Resnick and K.S. Krane,1994, Physics, 4th edition, Vols. 1,2 & 2 Extended Wiley, NY.
4. The Feynman, 1999, Handbook of Physics & Chemistry, 80th Ed., CRS Press, NY.
5. R.P. Feynman, 1998, Lectures on physics Vols, 1, 2& 3, R.B.Leighton and M.Sands, Narosa, New Delhi.

E LEARNING RESOURCES:

1. http://www.batesville.k12.in.us/physics/phynet/mechanics/mechoverview.html

2. https://www.britannica.com/science/mechanics

3. https://learn.saylor.org/course/view.php?id=16&sectionid=128

4. https://learn.saylor.org/course/resources.php?id=16

5. http://farside.ph.utexas.edu/teaching/301/lectures/node3.html

6. https://en.wikipedia.org/wiki/Classical_mechanics

Mapping of CO with PSO:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S
Average	S	S	S	S	S

PEDAGOGY: Chalk and talk, PPT, Lectures, Group discussions and seminars

ALLIED PAPER II-SEMESTER-II

ALLIED PHYSICS - II

Subject code: 20UMAAT2D02 Total hours: 4
L-T-P: 4-0-0 Credit: 4

COURSE OBJECTIVES:

1. Understand the concept of dispersion of light, vector atom model and nuclear model
2. Explore the arrangement of electrons in atoms
3. Construct basic logic gates and analyse Demorgan's theorem

COURSE OUTCOMES:

Co No.	CO Statement
CO 1	Discuss the concepts in optics and their significance in modern society.
CO 2	Understand the vector atom model and evaluate the quantum numbers and electronic configurations
CO 3	Explain the nuclear fission, fusion and evaluate the values of half life and mean life values
CO 4	Understand some practical applications of low temperature physics
CO 5	Demonstrate the basic concepts behind working of logic gates.

UNIT I: OPTICS **15 hrs**

Dispersion of light – Angular dispersion – Dispersive power -Combination of two prisms - Combination of two prisms to produce dispersion without deviation and deviation without dispersion. – Interference in wedge shaped films-Determination of Diameter of a wire.

UNIT II: ATOMIC PHYSICS **15 hrs**

Atom model – vector atom model –Quantum numbers associated with vector atom model-Pauli's exclusion principle and its applications – Coupling Schemes-L-S Coupling –j-j Coupling.

UNIT III: NUCLEAR PHYSICS **15 hrs**

Nuclear model – liquid drop model- semi empirical mass formula-– nuclear energy – mass defect – Binding energy - Nuclear fission and fusion – Radio activity – Properties of Alpha, Beta, Gamma rays – Law of radioactive disintegration- Exponential law – Expression for Half-life period and mean life period.

UNIT IV: LOW TEMPERATURE PHYSICS **15 hrs**

Joule Thomson effect – Porous plug experiment – Theory and applications – Liquefaction of air – Linde's method – Practical applications of low temperature.

UNIT V: ELECTRONICS **15 hrs**

AND, OR, NOT gates (Truth tables) – NAND and NOR gates – Universal building Blocks – Boolean algebra – De Morgan's theorem – verification of De Morgan's theorem.

BOOKS FOR STUDY:

1. R.Murugeshan, 2005, Allied physics I& II, S.Chand & Co pvt. Ltd., New Delhi.
2. Brij Lal and Subramanian N, 2006, Textbook of optics, S.Chand & Co., Ltd., New Delhi.
3. N. Subramaniam and Brij Lal, 2000, Atomic and Nuclear Physics, S. Chand & co, 5^{th} Edition.

BOOKS FOR REFERENCE:

1. R.Murugeshan, 2005, Modern Physics S. Chand & Co. pvt. Ltd., New Delhi.
2. D.Halliday, R.Resnick and K.S.Krane, 1994, Physics, 4^{th} Edition, Vols 1, 2 Wiley,NY.
3. Malvino Leach, 1992, Digital Principles and Application, Tata McGraw Hill, 4th Edition.

E LEARNING RESOURCES:

1. http://jiwaji.edu/pdf/ecourse/physics/Liquid%20drop%20Nuclear%20Model.pdf
2. https://www.tutorialspoint.com/computer_logical_organization/logic_gates.htm
3. https://www.physicsclassroom.com/class/refrn/Lesson-4/Dispersion-of-Light-by-Prisms

Mapping of CO with PSO:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	M
CO2	S	S	S	S	M
CO3	S	M	S	S	M
CO4	S	M	M	S	M
CO5	S	S	S	S	M
Average	S	S	S	S	M

PEDAGOGY: Chalk and talk, PPT, Lectures, Group discussions and seminars

CORE MAJOR PRACTICALS - I

Subject code: 20UPHCP2001
Int. mark: 40
Ext. mark: 60

Total hours: 3
Credit: 2
L-T-P: 0-0-3

COURSE OBJECTIVES:

1. Understand the concepts of uniform, non uniform bending and torsion oscillations
2. Gain knowledge on specific heat capacity of liquid and solids
3. Able to understand concept of the focal length of concave and convex lens, refractive index of the material of the prism

COURSE OUTCOMES:

Co No.	CO Statement
CO1	Apply the knowledge of elasticity, surface tension, viscosity to compute the properties of materials
CO2	Demonstrate the voltmeter calibration and basic logic gates
CO3	Compute the values of focal length, refractive index, specific heat capacity and specific resistance etc

ANY FIFTEEN EXPERIMENTS

1. Young's modulus – Non-uniform bending - Pin & Microscope
2. Young's modulus – Uniform bending – Optic lever
3. Rigidity modulus – Torsional pendulum (without identical masses)
4. Rigidity modulus - Torsional pendulum (with masses)
5. Surface tension of a given liquid by drop weight method
6. Interfacial surface tension between two liquids by drop weight method.
7. Coefficient of viscosity of liquid – Graduated burette (radius of capillary tube given)
8. Sonometer – Frequency of tuning fork and mass of the solid.
9. Sonometer –R.D. of a solid and liquid.
10. Specific heat capacity of liquid –Newton's law of cooling
11. Specific heat capacity of liquid – Method of mixtures(Half-time correction)
12. Focal length, power, R and μ of a convex lens.
13. Focal length, Power, R and μ of a concave lens.

14. Spectrometer - μ of a Solid.
15. Spectrometer- μ of a liquid.
16. P.O. Box –Specific resistance. of a coil
17. Potentiometer – Voltmeter Calibration.
18. Study of basic logic gates.

BOOKS FOR STUDY:

1. M.N.Srinivasan, 2011, **Practical Physics,** S.Chand and Co.
2. M.Arul Thalapathy, **Practical Physics**, Comptek Publishers.

Mapping of CO with PSO:

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	M
CO2	S	S	S	S	M
CO3	S	S	S	S	M
Average	S	S	S	S	M

ALLIED PHYSICS PRACTICALS - I

Subject code: 20UMAAP2D01
Int. mark: 40
Ext. mark: 60

Total hrs: 2
Credit: 2
L-T-P: 0-0-2

COURSE OBJECTIVES:

1. Understand and demonstrate experiments to study the properties of matter
2. Understand the principle of potentiometer and calibrate it
3. Construct and Verify the basic logic gates

COURSE OUTCOMES:

Co No.	CO Statement
CO1	Asses the elastic nature of materials
CO2	Calibrate the voltmeter using potentiometer
CO3	Understand the phenomenon of interference
CO4	Construct basic logic gates and verify its truth table

ANY FIFTEEN EXPERIMENTS

1. Young's modulus by non-uniform bending using Pin and microscope.
2. Young's modulus by non-uniform bending using Optic lever – Scale and telescope
3. Rigidity modulus by Static torsion method.
4. Rigidity modulus by torsional oscillations.
5. Surface tension - Drop Weight method
6. Interfacial torsion between two liquids by Drop Weight method.
7. Comparison of viscosities two liquids – Burette method.
8. Specific heat Capacity of a Liquid – Half – Time correction.
9. Sonometer – A.C. Frequency.
10. Newton's rings Radius of curvature.
11. Air wedge – thickness of a wire.
12. Spectrometer – grating – wavelength of Hg lines.
13. Potentiometer – voltmeter calibration.

14. P.O. Box – Specific resistance.
15. B.G - Figure of merit.
16. Study of AND,OR,NOT gates – using IC
17. Zener Diode – Characteristics.
18. NAND gate as a universal gate.
19. NOR gate as a universal gate.
20. Verification of DeMorgan's theorem.

BOOKS FOR STUDY:

1. M.N.Srinivasan, 2011, Allied Practical Physics, S.Chand and Co.
2. M.Arul Thalapathy, Allied Practical Physics, Comptek Publishers.

Mapping of CO with PSO:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	S	L
CO2	M	S	S	S	L
CO3	M	S	S	S	L
CO4	M	S	S	S	L
Average	M	S	S	S	L

SYLLABUS

II YEAR — MAJOR

III & IV SEMESTER

CORE PAPER V SEMESTER III

MATHEMATICAL PHYSICS AND STATISTICAL MECHANICS

Subject code: 20UPHCT3005 Total hours: 5
L-T-P: 5-0-0 Credit: 4

COURSE OBJECTIVES:

1. To prepare for getting knowledge of the fundamental concepts of matrices.
2. To use the concepts and applications of beta, gamma and special functions.
3. To analyze the basic fundamentals and concepts involved in classical and quantum statistics.

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Apply the mathematical formula of matrices in order to understand the basic and advanced physics.
CO2	Provide the students with an idea of beta and gamma functions which are essential tool in problem solving.
CO3	Gain deeper understanding of special functions and its basic concepts.
CO4	Endow with elementary ideas on classical statistics and will be able to write equations for real time problems using classical statistics.
CO5	Finding application of physical quantities using quantum statistics.

UNIT I: MATRICES **15 hrs**

Types of matrices - Characteristic equation of a matrix - Eigen Values and Eigen vectors - Cayley –Hamilton Theorem - Diagonalization of 3x3 real symmetric matrices - Applications.

UNIT II BETA AND GAMMA FUNCTION **15 hrs**

Definition - Beta function- Gamma function - Evaluation of Beta function- Other forms of Beta function - Evaluation of Gamma function - Other forms of Gamma function - Relation between Beta and Gamma functions - Simple problems.

UNIT III SPECIAL FUNCTIONS **15 hrs**

Series solution for Hermite Differential equation - Series solution for Bessel's Differential equation - Series solution for Legendre Differential equation - Series solution for Laguerre Differential equations.

UNIT IV CLASSICAL STATISTICS **15 hrs**

Phase Space - Micro and Macro states - Thermodynamic probability - Ensembles - Types of Ensembles - Postulates of statistical mechanics - Maxwell - Boltzmann distribution law- Maxwell - Boltzmann distribution law in terms of temperature - Application of Maxwell - Boltzmann distribution to an Ideal gas.

UNIT V QUANTUM STATISTICS **15 hrs**

Postulates of Quantum statistics - Bosons and Fermions - Derivation of Bose-Einstein distribution law - Application of Bose - Einstein distribution law - Derivation of Fermi - Dirac distribution law - Application of Fermi - Dirac distribution law - Comparison of three statistics.

BOOKS FOR STUDY:

1. B.D Gupta, 2006, Mathematical Physics, 4th Edition, Vikas Publishing House.
2. Sathya prakash, C. Agarwal Kedarnath, Ramnath, 2021, Statistical Mechanics, KNRN Publishers.
3. Sathya Prakash, 2014, Mathematical Physics, 6th edition, Sultan Chand Publishers.
4. R. K Pathria, Paul D. Beale, 2011, Statistical Mechanics, Elsevier Publisher.
5. F. Reif, 2010, Fundamentals of Statistical and Thermal Physics, Sarat Book Distributors.

BOOKS FOR REFERENCE:

1. Rajput, 2017, Mathematical Physics, Pragathi Pragasan Publishers.
2. H. K Dass, 2018, Mathematical Physics, 8th edition, Sultan Chand & Co. Ltd. Publishers.
3. Arfken, Weber, Harris, 2012, Mathematical Methods for Physicists, 7th edition, Elsevier Publishers.
4. R. Murugesan, 2017, Mechanics and Mathematical Physics, 3rd edition, Sultan Chand & Co. Ltd. Publishers.
5. Tai. L. Chow, 2000, Mathematical Methods for Physicists Cambridge University Press.

E-LEARNING RESOURCES:

1. https://www.khanacademy.org/math/algebra-home/alg-matrices
2. http://www.physics.wm.edu/~finn/home/MathPhysics.pdf
3. https://www.britannica.com/science/Maxwell-Boltzmann-distribution-law
4. http://hyperphysics.phyastr.gsu.edu/hbase/quantum/disbe.html#:~:text=The%20Bose%2DEinstein%20distribution%20describes,a%20phenomenon%20called%20%22condensation%22.
5. https://www.electrical4u.com/fermi-dirac-distribution-function/

Mapping of CO with PSO:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	S	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	M	S
CO5	S	M	M	S	S
Average	S	S	S	S	S

PEDAGOGY: Chalk and talk, PPT, Lectures, Group discussions and seminars

CORE PAPER VI SEMESTER III

OPTICS AND SPECTROSCOPY

Subject code: 20UPHCT3006 Total hours: 4
L-T-P: 4-0-0 Credit: 4

COURSE OBJECTIVES:

1. Learn the Concept of Aberration in lenses and their applications.
2. To study the concepts of interference and diffraction, polarisation
3. Understand the theory and application of spectroscopy

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Creates an in depth understanding of wave phenomena of light, namely, interference and diffraction, polarisation and basics of spectroscopy.
CO2	Gain knowledge on interferometers and different types of optical instruments.
CO3	Discuss the theories for the production of polarization of light
CO4	Explains the natural behaviour of aberration in lens.
CO5	Analyze the theory to do the experiment of interference using air wedge and newtons rings.

UNIT I: GEOMETRICAL OPTICS 15 hrs

Lens system - Types of lenses - Aberration in lenses - Spherical aberration in a lens - Chromatic aberration in lenses – Dispersion of light – Dispersion through a prism – Cauchy's Formula - Achromatic prisms - Combination of prisms to produce Dispersion without deviation - Deviation without dispersion. Eyepieces - Huygens' eyepiece - Ramsden's eyepiece - Comparison of eyepieces.

UNIT II: INTERFERENCE 15 hrs

Introduction - Theory of interference fringes - Newton's rings- Determination of wavelength of sodium light. Colors of thin films - Interference by reflected and transmitted light. Wedge shaped film - Determination of thickness of the thin wire –Testing of optical flatness. Michelson's Interferometer - Types of fringes - Applications - Determination of wavelength of monochromatic light and difference in wavelength between two neighbouring lines.

UNIT III: DIFFRACTION **15 hrs**

Introduction - Fresnel diffraction - Fraunhofer diffraction - Rectilinear propagation of light - Zone plate theory - Zone plate acts as converging lens - Difference between interference and diffraction - Plane diffraction grating - Plane transmission grating element - Oblique incidence - Absent spectra - Overlapping spectra - Normal incidence - Dispersive power of a grating. Resolving power - Rayleigh's criterion for resolution - Limit of resolution of the eye.

UNIT IV: POLARISATION OF LIGHT **15 hrs**

Types of polarized light - Theory of the production of elliptically and circularly polarized light - Quarter wave plate and Half wave plate - Production and detection of plane, circular and elliptically polarized light - Optical activity - Biot’s law - Specific rotation - Laurent’s half shade polarimeter.

UNIT V: INTRODUCTION TO SPECTROSCOPY **15 hrs**

Characterization of electromagnetic radiation - Quantization of energy - Regions of the spectrum - Basic elements of practical spectroscopy - Width of spectral lines - Intensity of spectral lines - Selection Rules - Born Oppenheimer Approximation - Types of Molecular Spectra - Instrumentation of Spectrophotometer(Outline) - Application of spectroscopy.

BOOKS FOR STUDY:

1. Murugesan R. and Kiruthiga Sivaprasath, 2006, Optics and Spectroscopy, S. Chand & Co., New Delhi.

2. Subramanian N., BrijLal and M. N. Avadhanulu, 2006, A Text book of Optics, S. Chand & Co., New Delhi.

3. Banwell C.N & Mc Cagh, 2017, Fundamentals of Molecular Spectroscopy, Tata Mc Graw Hill Publishing Co Ltd., IV Edition, New Delhi.

4. Gupta S.L.,Kumar V., Sharma .R.C., Pragathi Prakashan,1980, Elements of Spectroscopy Meerut.

BOOKS FOR REFERENCE:

1. Ajay Ghatak, 1998, Optics, Tata McGraw-Hill publishing Co. Ltd., New Delhi.

2. Khanna D. R. &Gulati H. R., 1979, Optics, S. Chand & Co., New Delhi.

3. Jenkins & White, 1981, Fundamental of optics, (4th edition), McGraw Hill.

4. Halliday D., Resnick R. and Walker J., 2001, Fundamentals of Physics, (6th Edition), Wiley, New York.

5. Lipson H. and Tannhauser D.S, Lipson S.G., 1995, Optical Physics, (3rd edition), Cambridge University press.

E-LEARNING RESOURCES:

1. https://www.youtube.com/watch?v=RpOByUcmyOg&ab_channel=ProfLecture
2. https://www.youtube.com/watch?v=e2MArppYcM4&list=PLCvpYrhOPdiWKu734tjeevs2-O0B7MJ1g&ab_channel=Ch-22Physics%5BIIT-PAL%5D
3. https://www.mheducation.co.in/fundamentals-for-molecular-spectroscopy-9789352601738-india
4. http://oaq.epn.edu.ec/infrarrojo/phocadownload/14 cernicharo_molecular_spectroscopy.pdf

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	S	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	M	S
CO5	S	S	S	S	S
Average	S	S	S	S	S

PEDAGOGY: Chalk and talk, PPT, Lectures, Group discussions and seminars.

ALLIED PAPER I-SEMESTER-III

ALLIED PHYSICS – I

Subject code: 20UCHAT3001 Total hours: 4
L-T-P: 4-0-0 Credit: 4

COURSE OUTCOMES:

1. To understand the concepts of simple harmonic motion.
2. To describe the concept of stress/strain and in its relation to force/displacement.
3. To Study the heat capacity of liquids and thermal conductivity of solids and to understand laws of sound.
4. To understand the utility of electric and magnetic phenomena.

CO No.	CO Statement
CO1	Explains the physical characteristics of SHM and obtaining solution of oscillator using differential equations. Use Lissajous figures to understand simple harmonic vibrations of same frequency and different frequencies.
CO2	Analysis of stress and deformation. Understanding the bending behaviour beams and analyses the expression for young's modulus.
CO3	Learning the basic concepts of surface tension and viscosity and evaluating their values for various materials.
CO4	Ability to know about the solids, liquids, gases and changes of state in constant pressure and constant volume. Explore the production and application of ultrasonic wave.
CO5	Understand and analysis the laws of electricity and magnetism and their verifications.

UNIT I: WAVES AND OSCILLATIONS **15 hrs**

Simple Harmonic Motion - Composition of two Simple harmonic motions in a straight line- Composition of two Simple harmonic motions of Equal time periods at right angles - Lissajous figures - Experimental method for obtaining Lissajous figures - Uses. Free, Damped and forced vibrations - Definitions only - Statement of Fourier theorem.

UNIT II: ELASTICITY **15 hrs**

Elastic constants - Different Moduli of Elasticity - Poisson's Ratio - Energy stored in a Stretched wire - Bending of Beams - Expression for the Bending Moment - Experiment to determine young's modulus by non-uniform bending. Determination of Rigidity Modulus - static torsion method (scale and telescope) - Torsion Pendulum - Experiment to determine rigidity modulus by torsional pendulum.

UNIT III: VISCOSITY AND SURFACE TENSION **15 hrs**

Streamline flow and Turbulent flow - Coefficient of viscosity - Derivation of Poiseuille's formula - Comparison of viscosities of two liquids - Terminal Velocity - Stokes Law- Lubrication.

Surface tension - Molecular theory of Surface Tension - Pressure difference across Liquid Surface - Excess of Pressure inside a drop and bubble - Method of drops - Determination of surface tension and interfacial surface tension - Drop weight method.

UNIT IV: HEAT AND SOUND **15 hrs**

Postulates of Kinetic theory of gases - Vanderwaal's equation of state - Derivation of critical constants - Ultrasonics - Production of ultrasonic waves - Piezo electric crystal method - Magnetostriction method - Properties - Application to science, industry and medicine

UNIT V: ELECTRICITY AND MAGNETISM **15 hrs**

Capacitor - energy of charged capacitor - Loss of energy due to sharing of charges .Potentiometer - Principle of Potentiometer - Calibration of low range voltmeter using potentiometer. Magnetic effect of electric current - Magnetic field due to a current carrying conductor - Biot-Savart's law - Magnetic induction at a point on the axis of a circular coil.

BOOKS FOR STUDY:

1. Properties of Matter and Acoustics, R. Murugesan, Reprint 2017, 2nd Edition, S. Chand & Co. Ltd.
2. Allied physics I & II by R. Murugeshan, 2005, S. Chand & Co pvt. Ltd., New Delhi.
3. Heat and Thermodynamics, Brij lal and Subramaniam, 2001, S.Chand (G/L) & Company Ltd.

4. Electricity and magnetism, S Chand & Co. Ltd, R. Murugesan, Reprint (2014), Revised edition, Chand & Co.

BOOKS FOR REFERENCE:

1. Thermal Physics - R. Murugesan, 2015, S. Chand and Publishing.
2. Modern Physics, Murugesan, Kiruthiga Sivaprasath, Reprint (2006),Twelth Revised Edition, Chand & Co. Ltd.
3. Elements of properties of matter by Mathur. D. S, 2003, Shyamlal Charitable trust, New Delhi.
4. Mechanics – D.S. Mathur – S. Chand& Co, II edition, 2001.
5. Physics, 4th Edition, Vols.1,2&2 extended by D. Halliday, R. Resnick and K.S. Krane, Wiley, NY, 1994.

E-LEARNING RESOURCES:

1. https://www.physicstutoronline.co.uk/alevelphysicsnotes/
2. https://www.khanacademy.org/science/physics/elasticity/surface tension/
3. https://physics.info/sho/
4. https://www.uen.org/core/science/sciber/TRB6/downloads/06literacy.pdf

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	M	S	S
CO2	S	S	S	M	S
CO3	S	S	S	S	S
CO4	S	S	S	S	M
CO5	S	M	M	M	M
Average	S	S	S	S	S

PEDAGOGY: Chalk and talk, PPT, Lectures, Group discussions and seminars.

CORE PAPER VII SEMESTER IV

ATOMIC PHYSICS

Subject code: 20UPHCT4007 Total Hours: 4
L-T-P: 4-0-0 Credit: 4

COURSE OBJECTIVES

1. Provide a detailed study of the structure of the atom, its energy states and its interactions.

2. Have an exposure of important phenomena related to atoms such as Zeeman splitting.

3. Inspire the concepts of LASER and their applications.

CO No.	CO Statement
CO1	Explains about vector atom model
CO2	Analyse various types of spectrographs to study about the positive rays
CO3	Critique the atomic behaviour in external applied electric and magnetic fields
CO4	Assess the concepts of X-rays production and the experiments to find X-ray spectra
CO5	Analyse the concepts of LASER

UNITI: ATOM MODEL 15 hrs

Vector atom model - spatial quantization, spinning electron - Quantum numbers associated with the vector atom model - Coupling schemes: L-S and j-j coupling - Magnetic dipole moment of electron due to orbital and spin motion -Bohr magneton – The Stern and Gerlach experiment: principle and experimental procedure - interpretation of the result.

UNIT II: ATOMIC SPECTRA 15 hrs

Optical spectra - Spectral terms - Spectral notations - selection rules - intensity rules - interval rule-fine structure of sodium D lines - Zeeman effect - Experimental arrangement for normal Zeeman Effect - Lorentz classical theory of normal Zeeman effect - Expression for the Zeeman Shift-Anomalous Zeeman Effect - Paschen Back effect - Stark effect (qualitative study only).

UNITIII: POSITIVE RAYS **15 hrs**

Positive rays - Discovery - Properties - Positive ray analysis - Thomson's Parabola method - action of Electric and Magnetic fields - Determination of e/m - determination of mass - discovery of stable isotopes - Limitations - Aston's mass spectrograph - Bainbridge's mass spectrograph.

UNIT IV: X-RAYS **15 hrs**

Discovery - Production, Properties and absorption of X - rays - origin and analysis of continuous and characteristic X-ray spectrum - Duane and Hunt Law - Bragg's Law - derivation of Bragg's law - Bragg's X-ray spectrometer - Mosley's law and its importance - Compton effect - Derivation of expression for change in wavelength - its experimental verification.

UNIT V: LASER **15 hrs**

Introduction - properties of lasers - Difference between ordinary light and laser beam- Absorption - spontaneous emission - stimulated emission - Einstein's coefficients - Principle of laser action - Population inversion - threshold condition for laser action - Pumping methods- construction, working and characteristics of Ruby laser. Applications of Lasers in communication and medicine.

BOOKS FOR STUDY:

1. Murugesan R., 2018, Modern Physics, 9th Edition S.Chand & Co.
2. J. B. Rajam, 2007, Atomic Physics, S Chand & Co.
3. Avadhanulu M.N. and Dr. Hemne P.S., 2001,An Introduction to LASER Theory and Applications, S. Chand Publishing.

BOOKS FOR REFERENCE:

1. Arora C.L., 1999, Atomic and Molecular Physics., 1st edition, S Chand & company Ltd.
2. Beiser, 2002, Concepts of Modern Physics, 6th Edition Tata McGraw Hill Publishers.
3. Kenneth S Krane., 2012, Modern Physics, 3rd Edition John Wiley and Sons.
4. Ajoy Ghatak and Thiagarajan, 1991, Optical Electronics., Cambridge University Press.

5. Searles & Zemansky, 2017, University Physics with Modern Physics, Young and Freedman Publication.

E-LEARNING RESOURCES:

1. https://www.youtube.com/watch?v=SQtOYCei-Pc
2. https://www.youtube.com/watch?v=PH1FbkLVJU4
3. https://www.youtube.com/watch?v=_JOchLyNO_w
4. https://www.youtube.com/watch?v=ClgqzrGYlsA
5. https://www.youtube.com/watch?v=AovUjLKaFBg

PEDAGOGY: Chalk and talk, PPT, Lectures, Group discussions and seminars.

Mapping of CO with PSO:

CO / PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	S	M	S	M	S
CO2	S	M	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S
Average	S	S	S	S	S

PEDAGOGY: Chalk and talk, PPT, Lectures, Group discussions and seminars.

CORE PAPER VIII SEMESTER IV

P8 - ELECTRICITY AND MAGNETISM

Subject code: 20UPHCT4008 Total Hours: 5
L-T-P: 5-0-0 Credit: 4

COURSE OBJECTIVES:

1. To prepare for deeper understanding of electric charges and its applications that is necessitate for advanced studies in physics.
2. To identify the concepts of electrical measurements using experimental techniques and to solve mathematical problems.
3. To compute the physical accuracy of thermoelectricity and also growth and decay of transient currents.
4. To discuss how magnetism is produced and where its effects are observed.

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Apply the knowledge of Gauss law with various dimensions of the object between electrical charge physical principles to solve problems encountered in everyday life.
CO2	Acquire knowledge on the fundamentals of potentiometer, ammeter and voltmeter and to compare the EMF of two cells using potentiometer. Develop, design and experiment with various electrical circuits.
CO3	Analyse the growth and decay of transient currents through mathematical techniques and problems.
CO4	Experiments have been carried out by various methods to evaluate electric potential, analyse and apply thermoelectric energy harvesting techniques.
CO5	Identify and apply magnetic effects and to relate the various magnetic field measurements.

UNIT I: GAUSS'S LAW **15 hrs**

Permittivity of free space – relative permittivity – electric field intensity – electric flux density – electric field intensity due to a point charge – Gauss law – statement and proof of Gauss law – Applications of Gauss law to an insulated conductor – electric field due to a

uniformly a charged sphere (conducting and non-conducting spheres) and uniformly charged non-conducting cylinder – Coulomb's theorem – mechanical stress on unit area of a charged conductor – application to electrified soap bubble.

UNIT II: ELECTRICAL MEASUREMENTS **15 hrs**

Carey Foster's bridge – Determination of resistance of the given wire with necessary theory – Potentiometer – Principle of Potentiometer – Calibration of ammeter – Calibration of High and low range voltmeter – Comparison of emf of two cells using potentiometer – Determination of internal resistance of the cell using potentiometer – Measurement of low resistance (Kelvin Double bridge method).

UNIT III: TRANSIENT CURRENTS **15 hrs**

Growth and decay of current in a circuit containing resistance and inductance – Growth and decay of charge in a circuit containing resistance and capacitor – Measurement of high resistance by leakage – Growth of charge in a circuit with inductance, capacitance and resistance – Decay of charge in a circuit with inductance, capacitance and resistance.

UNIT IV: THERMOELECTRICITY **15 hrs**

Seebeck effect – Peltier effect – Statements only – laws of thermoemf – Total emf in a thermocouple – Pyrroelectricity – Thermoelectric refrigerator – Thermoelectric effects in PN junction – Determination of the Peltier coefficient at a junction – Measurement of thermoemf using a potentiometer – Thermo electric diagrams and its applications.

UNIT V: MAGNETISM **15 hrs**

Magnetic induction (B) – Magnetisation (M) – Susceptibility – Permeability – Permittivity – Relation between the magnetic properties – Different types and properties of magnetic materials – Dia, Para, Ferro, Antiferro and Ferri magnetic materials – Antiferromagnetism and ferrimagnetism – The electron theory of magnetism – Langevin's theory of dia and paramagnetism – Magnetic domain – Weiss's theory of ferromagnetism – Hysteresis – Experiment to draw M-H curve – horizontal model – Energy loss due to hysteresis – Importance of hysteresis curves.

BOOKS FOR STUDY:

1. K. K. Tewari, 2001, Electricity and Magnetism, S. Chand & Co. Ltd.
2. R. Murugeshan, 2017, Electricity and Magnetism, S. Chand & Co. Ltd.

3. Brij Lal & N. Subrahmanyam, 2017, Electricity and Magnetism, 8th Edition, S. Chand & Co Ltd.
4. Sathyaprakash, 2012, Electricity and Magnetism, Pragati Publishers.
5. R. S. Sedha, 2008, A Text Book of Applied Electronics, S. Chand & Co. Ltd.

BOOKS FOR REFERENCE:

1. D. L Sehgal, K. L Chopra, N. K Sehgal, 2020, Electricity and Magnetism, S. Chand & Co.
2. D. C Tayal, 2019, Electricity and Electronics, Himalaya Publishing House.
3. D. Halliday, R. Resnick and J. Walker, 2001, Fundamentals of Physics, , 6th Edition, Wiley Publishers.
4. R.P. Feynman, R B Leighton and M. Sands, 2002, The Feynman Lectures on Physics, Vols.1, 2, and 3, Narosa Publishers.

E-LEARNING RESOURCES:

1. https://www.khanacademy.org/science/in-in-class-12th-physics-india/in-in-electrostatic potential-and-capacitance
2. https://www.sciencedirect.com/topics/engineering/seebeck-effect
3. https://www.britannica.com/science/thermoelectricity
4. https://www.electronics-tutorials.ws/electromagnetism/magnetism.html
5. https://www-spof.gsfc.nasa.gov/Education/Imagnet.html

Mapping of CO with PSO:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	M	M
CO4	S	S	S	S	S
CO5	M	M	S	M	M
Average	S	S	S	S	S

PEDAGOGY: Chalk and talk, PPT, Lectures, Group discussions and seminars.

ALLIED PAPER II-SEMESTER-IV

ALLIED PHYSICS - II

Subject code: 20UCHAT4002 Total Hours: 4

L-T-P: 4-0-0 Credit: 4

COURSE OBJECTIVES:

1. Explore the fundamental concepts of physics
2. Import knowledge about the importance of material properties, heat, sound, optics, atomic and nuclear physics.
3. Introduces the basic concepts of current electricity, electronics and digital electronics
4. Emphasize the significance of laws involved in electric circuits.

COURSE OUTCOMES:

CO No.	CO Statement
CO 1	Discuss the behavior of light on passing through lens, prism and thin film.
CO 2	Analyse the dynamics of atoms and simple molecules.
CO 3	Explains the ground state properties of the nucleus for study of the nuclear structure behavior.
CO 4	Develop the knowledge about Low temperature physics and analyse the applications in various areas
CO 5	Able to understand the basics of digital circuits. Capable to design different types of digital logic circuit.

UNIT I: OPTICS **15 hrs**

Refraction through a Thin prism – Dispersion through a prism – Dispersive power - Combination of two prisms - Combination of two prisms to produce dispersion without deviation and deviation without dispersion, Interference – Interference in thin films – Air Wedge – Expression for the fringe width - Determination of Diameter of a wire.

UNIT II: ATOMIC PHYSICS **15 hrs**

Vector atom model –Quantum numbers associated with Vector atom model- Coupling Schemes-L-S Coupling –j-j Coupling - Pauli's exclusion principle - Magnetic dipole moment due to orbital motion of the electron- Magnetic dipole moment due to spin.

UNIT III: NUCLEAR PHYSICS **15 hrs**

Nuclear model – liquid drop model – nuclear energy – mass defect – Binding energy – Radio activity – Nature of Alpha, Beta, Gamma rays – Exponential law – Expression for Half-life period and mean life period.

UNIT IV: LOW TEMPERATURE PHYSICS **15 hrs**

Joule Thomson effect - Porous plug experiment - Theory and applications - Liquefaction of air-Linde's method - Adiabatic Demagnetization - Practical applications of low temperature. Refrigeration – Frigidaire – Electrolux refrigerator.

UNIT V: ELECTRONICS **15 hrs**

AND, OR, NOT gates (Truth tables) – NAND and NOR gates – Universal building Blocks. Boolean algebra Postulates and theorems of Boolean Algebra– De Morgan's theorem – verification of De Morgan's theorem.

BOOKS FOR STUDY:

1. A Text Book of Optics by Subrahmaniyam N. Brij lal & Avadhanulu. 2006 23rd revised edition, S. Chand & Co pvt. Ltd.
2. Thermal Physics by Murugesan & Kiruthiga Sivaprasath. 2013, Revised Edition, S. Chand & Co pvt. Ltd
3. Allied physics I & II by Murugesan, 2006, Revised Edition, S. Chand & Co pvt. Ltd.
4. Modern Physics by Murugesan & Kiruthiga Sivaprasath. 2006, Twelth Revised Edition, Chand & Co. Ltd.
5. Heat and Thermodynamics by Brij lal and Subramaniam. 2006, Chand & Co. Ltd.

BOOKS FOR REFERENCE:

1. Fundamentals of Physics, by D. Halliday, R. Resnick and J. Walker. 2001, sixth edition Wiley, NY.
2. Physics, by D. Halliday, R. Resnick and K.S. Krane. 1994, fourth edition, Vols. 1 & 2 Extended Wiley, NY.
3. Handbook of Physics & Chemistry by The Feynman, 1999, 80th Ed., CRS Press, NY
4. Principles of Physics by Robert Resnick Jearl Walker, David Halliday, 2015, Tenth Edition, Wiley, NY.

E-LEARNING RESOURCES:

1. https://www.physicstutoronline.co.uk/alevelphysicsnotes/
2. https://www.khanacademy.org/science/physics/light-waves/introduction-to-light
3. https://nptel.ac.in/courses/104/104/104104085/
4. https://www.youtube.com/watch?v=josqjcH79PE&list=PLbMVogVj5nJRvq-w3zway7k3GzmUDte3a&ab_channel=nptelhrd
5. https://www.youtube.com/watch?v=o6Ep7-HELv8&ab_channel=Ch-22Physics%5BIIT-PAL%5D

Mapping of CO with PSO:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	S	S
CO2	S	M	S	S	S
CO3	S	S	S	S	S
CO4	S	M	M	S	S
CO5	S	S	S	S	S
Average	S	S	S	S	S

PEDAGOGY: Chalk and talk, PPT, Lectures, Group discussions and seminars.

CORE MAJOR PRACTICALS - II

Subject code: 20UPHCP4002 | Total Hours: 3
Int. mark: 20 | Credit: 2
Ext. mark: 30 | L-T-P: 0-0-3

COURSE OBJECTIVES:

1. Understand the concepts of uniform, non uniform bending and torsion oscillations

2. Gain knowledge on specific heat capacity of liquid and solids

3. Able to understand concept of the focal length of concave and convex lens, refractive index of the material of the prism

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Apply the knowledge of elasticity, surface tension, viscosity to compute the properties of materials
CO2	Demonstrate the voltmeter calibration and basic logic gates
CO3	Compute the values of focal length, refractive index, specific heat capacity and specific resistance etc

ANY 15 EXPERIMENTS ONLY

1. Young's Modulus-Cantilever-Depression-(Static method)-(scale and Telescope)
2. Young's Modulus-Cantilever oscillations-(Dynamic method)
3. Rigidity Modulus-Static torsion
4. Compound pendulum-g and k
5. Sonometer-A.C. frequency-Steel wire.
6. Melde's string-Frequency R.D. of a solid and liquid.
7. Specific heat capacity-Joule's calorimeter-half-time correction.
8. Thermal conductivity of a bad conductor-Lee's disc method.
9. Spectrometer-μ of a glass prism i-d curve.
10. Spectrometer-grating N and λ -Normal incidence method.
11. Spectrometer-grating N and λ-Minimum deviation method.
12. Air wedge-thickness of a wire.
13. m and B_H-Deflection magnetometer Tan C position and Vibration magnetometer.

14. B_H-by Copper Voltmeter and Tangent Galvanometer.
15. Carey Foster Bridge-Temperature coefficient of resistance.
16. Potentiometer-Ammeter Calibration.
17. Potentiometer-Resistance and Specific resistance of wire
18. Figure of merit of galvanometer (Mirror Galvanometer or Table Galvanometer).
19. Verification of De Morgan's theorem using IC.

BOOKS FOR STUDY:

1. M.N.Srinivasan, 2011, Allied Practical Physics, S.Chand and Co.
2. M.Arul Thalapathy, Allied Practical Physics, Comptek Publishers.

Mapping of CO with PSO:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M
CO2	S	S	S	S	M
CO3	S	S	S	S	M
Average	S	S	S	S	M

ALLIED PHYSICS PRACTICALS - I

Subject code: 20UCHAP4001
Int. mark: 20
Ext. mark: 30

Total Hours: 2
Credit: 2
L-T-P: 0-0-2

COURSE OBJECTIVES:

1. Understand and demonstrate experiments to study the properties of matter
2. Understand the principle of potentiometer and calibrate it
3. Construct and verify the basic logic gates

CO No.	Co statement
CO 1	Asses the elastic nature of materials
CO 2	Calibrate the voltmeter using potentiometer
CO 3	Understand the phenomenon of interference
CO 4	Construct basic logic gates and verify its truth table

ANY FIFTEEN EXPERIMENTS

1. Young's modulus by non-uniform bending using Pin and microscope.
2. Young's modulus by non-uniform bending using Optic lever – Scale and telescope
3. Rigidity modulus by Static torsion method.
4. Rigidity modulus by torsional oscillations.
5. Surface tension - Drop Weight method
6. Interfacial torsion between two liquids by Drop Weight method.
7. Comparison of viscosities two liquids – Burette method.
8. Specific heat Capacity of a Liquid – Half – Time correction.
9. Sonometer – A.C. Frequency.
10. Newton's rings Radius of curvature.
11. Air wedge – thickness of a wire.
12. Spectrometer – grating – wavelength of Hg lines.
13. Potentiometer – voltmeter calibration.
14. P.O. Box – Specific resistance.
15. B.G - Figure of merit.
16. Study of AND,OR,NOT gates – using IC

17. Zener Diode – Characteristics.
18. NAND gate as a universal gate.
19. NOR gate as a universal gate.
20. Verification of DeMorgan's theorem.

BOOKS FOR STUDY:

1. M.N.Srinivasan, 2011, Allied Practical Physics, S.Chand and Co.
2. M.Arul Thalapathy, Allied Practical Physics, Comptek Publishers.

Mapping of CO with PSO:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	S	M
CO2	M	S	S	S	M
CO3	M	S	S	S	M
CO4	M	S	S	S	M
Average	M	S	S	S	M

SYLLABUS

III YEAR — MAJOR

V & VI SEMESTER

CORE PAPER IX SEMESTER V

P9- ELECTROMAGNETISM

Subject code: 20UPHCT5009 Total Hours: 4
L-T-P: 4-0-0 Credit: 4

COURSE OBJECTIVES:

1. To utilize the knowledge on electromagnetism and emphasize the significance of alternating current
2. To assess the basic laws involved in electromagnetic induction and usage of standard experimental methods to calculate self and mutual induction
3. To analyze the physics concepts involved in generators and motors and its instrumentation is explained in a detailed manner
4. To utilize basic terms and equations involved in electromagnetic waves and write mathematical equations in various media

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Illustrate the practical purposes of alternating current and the related laws
CO2	Demonstrate the practical concepts of electromagnetic induction through experimental setup
CO3	Analyze the working and principle of induction motor and demonstrate the associated concepts
CO4	Exemplify the working and practical purposes of generators and motors.
CO5	Apply vector calculus in order to study the behavior of electric and magnetic fields in various media

UNIT I: ALTERNATING CURRENT **15 hrs**

Peak, average and RMS values of AC voltage and current – reactance and impedance – Impedance of AC circuit containing L, C and R – series and parallel resonant circuits-power and power factor in AC circuits – wattless current – choke coil.

UNIT II: ELECTROMAGNETIC INDUCTION I **15 hrs**

Faraday's laws of electromagnetic induction – Expression for self-induction – Self-inductance of a solenoid – determination of self – inductance by Raleigh's method –mutual induction – Experimental determination of mutual inductance between a pair of co-axial coils – coefficient of coupling – Eddy currents – Uses of Eddy currents.

UNIT III: ELECTROMAGNETIC INDUCTION II **15 hrs**

A Conducting rod moving through a uniform magnetic field – Inductances in series – Inductances in parallel – Self-inductance of coaxial cylinders-rotating magnetic field (Principle of an Ac Induction motor) – Working of single phase induction motor.

UNIT IV: GENERATORS AND MOTORS **15 hrs**

Three phase Ac generator – DC dynamo – series wound dynamo – shunt wound dynamo – compound wound dynamo – DC motor.

UNIT V: MAXWELLS EQUATIONS AND ELECTROMAGNETIC WAVES **15 hrs**

Introduction – displacement current – Magnitude of displacement current – Maxwells equations (Gauss's Law of electrostatics, Gauss's Law of magnetic induction, Ampere's Law, Faradays law of induction) – Maxwells equations in material media – Plane electromagnetic waves in free space – velocity of light – Poynting vector –Hertz experiment for production and determination of electromagnetic waves.

BOOKS FOR STUDY:

1. Sathyaprakash, 2012, Electricity and Magnetism, Pragati Publishers.
2. K. K. Tewari, 2001, Electricity and Magnetism, 3rd Edition, S. Chand & Co. Ltd Publishers.
3. R. Murugeshan, 2017, Electricity and Magnetism, 10th Edition, S. Chand & Co. Ltd Publishers.
4. S.R. Manohara and A. Subha, 2018, Electricity, Magnetism and Electromagnetic Theory, S. Chand & Co. Ltd Publishers.

BOOKS FOR REFERENCE:

1. Brijlal & Subramanian, 2006, Electricity and Magnetism, 8th Edition, S. Chand & Co. Ltd Publishers.
2. D. Chattopadhyay, 2011, Electricity and Magnetism, Allied publications.
3. John Dirk Walecka, 2018, Introduction to Electricity and Magnetism, World Scientific Publishers.
4. I.E. Irodov, 2004, Basic laws of Electromagnetism, CBS Publishers.

5. R. P. Feynman, R B Leighton and M. Sands, 2002, The Feynman Lectures on Physics, Vols.1, 2 and 3, Narosa Publishers.
6. David J. Griffiths, 2020, Introduction to Electrodynamics, South Asia Edition.

E-LEARNING RESOURCES:

1. https://www.toppr.com/guides/physics/magnetic-effects-of-electric%20current/electromagnetic-induction-and-its-applications/
2. https://byjus.com/physics/induction/
3. https://intl.siyavula.com/read/science/grade-12/electrodynamics/11-electrodynamics-02
4. https://www.maxwells-equations.com/
5. https://www.electronics-tutorials.ws/accircuits/series-circuit.html

Mapping of CO with PSO:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	M	S
CO5	S	M	M	S	M
Average	S	S	S	S	S

PEDAGOGY: Chalk and talk, PPT, Lectures, Group discussions and seminars.

CORE PAPER X SEMESTER V

FUNDAMENTALS OF NANOSCIENCE AND NANOTECHNOLOGY

Subject code: 20UPHCT5010 Total Hours: 5
L-T-P: 5-0-0 Credit: 4

COURSE OBJECTIVES:

1. To understand the nature of materials in nano-size and nano-structures
2. To learn bulk synthesis of Nano materials and advanced analytical method used to study nanomaterials.
3. To know about Physical and chemical approaches of Nano material synthesis.
4. To learn about sensor fabrication and applications.
5. To develop skills to synthesize nanomaterials.

COURSE OUTCOMES:

CO No	CO Statement
CO1	Explains the principles and background of nanotechnology.
CO2	Discuss the concepts of Material science and material handling aspects of nanomaterials.
CO3	Utilize the knowledge for analysis and characterization of nanomaterials.
CO4	Identify the concepts of Nanoeletronics and Nanosensor
CO5	Students will able to design the nano sensor components and improved application of Nanotechnology.

UNIT I: INTRODUCTION AND TYPES OF NANOSTRUCTURE MATERIALS 15 hrs

Length scales in physics - Nanostructures: 1D, 2D and 3D nanostructures (nanodots, thin films, nanowires and nanorods) **–** Confinement effects**.** Band structure and density of states of materials at nanoscale, Size dependent properties in nano systems – Magnetic, electrical, optical, mechanical, thermal properties.

UNIT II: SYNTHESIS OF NANO MATERIALS 15 hrs

Metals - Metal Oxide-Carbon based nanomaterials CNT-C60-graphene. Top down and Bottom up approach - Photolithography. Ball milling. Gas phase condensation. Vacuum deposition.

Physical vapour depositions (PVD) - Thermal evaporation - Chemical vapour deposition (CVD).Sol-Gel.

UNIT III: CHARACTERIZATION OF NANOMATERIALS 15 hrs

X-ray diffraction (XRD)-Atomic force Microscope-Imaging modes-Contact mode-Tapping mode-Non-contact mode-Topographic image - Scanning Electron microscope-Scanning process and image formation-Detection of secondary electrons-Detection of backscattered electrons. Tranmission Electron microscope-differences between a TEM and a Light Microscope.

UNIT IV: NANOELECTRONICS AND SENSORS 15 hrs

Nanoelectronic Devices- Spintronics- Optoelectronics- Displays- Nanoelectronics in Energy- Molecular Electronics - Nanosensor- Characteristics- Nanosensor fabrication- Nanosensor based on nanoparticles and nanoclusters - Nanosensor based on nanowires, nanofibers and carbon nanotubes- Nanosensor based on graphene.

UNIT V: **APPLICATIONS OF NANOTECHNOLOGY 15 hrs**

Everyday Materials and Processes-Electronics and IT Applications- Medical and Healthcare Applications-Energy Applications- Environmental Remediation-Future Transportation Benefits-Maintaining the Focus on the Benefits of Nanotechnology via EHS and ELSI Efforts. Immunodiagnostics for cancer and central nervous system disorders. Improved diagnosis by in vivo imaging - detection of tumours – Nano toxicology.

BOOKS FOR STUDY:

1. Sunipa Roy (Editor), Chandan Kumar Ghosh (Editor),2017, Nanotechnology: Synthesis to Applications 1st edition, CRC Press.
2. Cao, Guozhong, 2011, Nanostructures and Nanomaterials - Synthesis, Properties and Applications World Scientific Publishing Company.
3. Maria Benelmekki, April 2015, An introduction to nanoparticles and nanotechnology, Morgan & Claypool Publishers.
4. Yadong Yin , Yu Lu , Yat Li , Yiding Liu , Le He , Yihan Zhu , Yu Han, 2019, Handbook Of Synthetic Methodologies And Protocols Of Nanomaterials (In 4 Volumes)(World Scientific Series In Nanoscience And Nanotechnology

18) Format: Kindle Edition.

5. Frank Owens Charles Poole, 2007, Introduction to Nanotechnology Paperback Wiley.

BOOKS FOR REFERENCE:

1. Leon L. Shaw, 2005, Processing & properties of structural nanomaterials Nanochemistry: A Chemical Approach to Nanomaterials, Royal Society of Chemistry, Cambridge UK.
2. J.George, 2005, Preparation of thin films, Marcel Dekker, InC., New York.
3. W. Ranier, 2003, "Nano Electronics and Information Technology", Wiley.
4. Hari Singh Nalwa, 2004, Encyclopedia of Nanoscience and Nanotechnology Journal of Nanoscience and Nanotechnology
5. Bharat Bhusan, 2004, Springer Handbook of Nanotechnology Springer Handbooks.

E-LEARNING RESOURCES:

1. https://www.nanowerk.com/nanoelectronics.php
2. https://www.nano.gov/you/nanotechnology-benefits
3. https://www.ccber.ucsb.edu/ucsb-natural-history-collections-botanical-plant-anatomy/transmission-electron-microscope
4. Please visit the Environmental, Health, and Safety Issues and the Ethical, Legal, and Societal Issues pages on nano.gov to learn more about how the National Nanotechnology Initiative is committed to responsibly addressing these issues.

Mapping of CO with PSO:

COs/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	M	S
CO2	S	S	S	S	S
CO3	S	S	S	M	S
CO4	S	M	S	S	S
CO5	S	S	S	S	S
Average	S	S	S	S	S

PEDAGOGY: Chalk and Talk, PPT, Lectures, Group discussions and seminars.

CORE PAPER XI SEMESTER V

NUCLEAR PHYSICS

Subject code: 20UPHCT5011 Total hours: 5
L-T-P: 5-0-0 Credit: 4

COURSE OBJECTIVES:

1. To impart the understanding of the sub atomic particles and their properties.

2. Emphasize to gain knowledge about the different nuclear techniques and their applications in different branches of Physics and societal application.

3. To gain the basic ideas of the construction and working of different kinds of particle accelerators along with their practical influences.

4. Enlighten the students about the fundamental nature of matter and their importance in various fields.

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Understand and appreciate the fundamental concepts of Nuclear Physics and nuclear models.
CO2	Apply basic concepts of radioactivity in solving problems.
CO3	Analyze and compare the significance of various types of particle accelerators.
CO4	Analyze expand and evaluate the construction and working of radiation detectors and the behavior of nuclear particles.
CO5	Acquire the basic knowledge of cosmic rays and elementary particles.

UNIT I: GENERAL PROPERTIES OF NUCLEI AND NUCLEAR MODELS 15 Hrs

Classification of nuclei - Nuclear size, Density, Charge, Mass - Determination of nuclear radius - Mirror nucleus method - Mass defect and Binding energy - Packing Fraction - Nuclear stability - Magnetic dipole moment - Electric quadrupole moment - Parity.

Nuclear models - Liquid drop model- Weizacker semi empirical mass formula- Magic numbers - Nuclear Shell model - Spin - orbit coupling - Collective model (outline).

UNIT II: RADIOACTIVITY **15 hrs**

Natural radioactivity - Units of radioactivity - Properties of alpha, beta and gamma rays - Determination of decay constant - Expression for Half-life and Mean life period - Relation between half - life and mean life - Geiger - Nuttal Law - Gamow's theory of α- decay - Tunnelling effect - Neutrino theory of β - decay, k- electron capture, Gamma ray - Origin, nuclear isomerism, internal conversion.

Soddy- Fajan's displacement law - Law of successive disintegration and radioactive equilibrium - Transient and Secular equilibrium - Applications of nuclear radiations: Industrial, medical and agriculture.

UNIT III: PARTICLE ACCELARATOR **15 hrs**

The linear accelerator - The cyclotron - The synchrocyclotron - The proton synchrotron - Betatron - Accelerator facility available in India - Applications.

UNIT IV: RADIATION DETECTORS **15 hrs**

Interaction between Energetic Particles and matter - Ionization chamber - Proportional counter - Geiger Muller counter - The Wilson cloud chamber - Bubble Chamber - The Scintillation Counters – Cerenkov Counter.

UNIT V: COSMIC RAYS and ELEMENTARY PARTICLES **15 hrs**

Discovery of cosmic rays - Latitude effect - Azimuth effect - Altitude effect - origin of cosmic rays - Primary and Secondary cosmic rays - Extension of Cosmic ray shower - detection of cosmic ray particles - Van Allen Belts.

Introduction of Elementary Particles - Particles and Antiparticle - Antimatter - The fundamental interaction - Quantum numbers of elementary particles.

BOOKS FOR STUDY:

1. R. Murugesan, 2002, Modern Physics, 12th revised edition, S. Chand Co, Ltd.
2. S.N. Ghoshal, 1994, Atomic and Nuclear Physics Vol I & II, 2nd Edition, S. Chand & Co, Ltd.
3. Sathya Prakash, 2018, Nuclear Physics, Pragati Prakashan Meerut Publisher.
4. F.K. Rithchmyer, E.H. Kennard & John N. Copper, Introduction to Modern Physics, Tata Mc Graw Hill Pub Co Ltd., New Delhi.
5. Irving Kaplan, 2002, Nuclear Physics, Narosa Publication.

BOOKS FOR REFERENCE

1. R.P. Feynman, R.B. Leighton and M. Sands, 1989, The Feynman Lectures on Physics, Narosa Publishing House Addison, Wesley Publishing Company.
2. Robert Resnick and David Halliday, 1969, Physics Part I and II, Wiley Eastern Private Limited, New Delhi.
3. T. A Little Field and Thorley, Atomic and Nuclear Physics, 3rd Edition, Elbs and Van Nostrand Reinhold Co., Ltd., London.
4. Young Hugh D & Freedman Roger, 2017, University Physics with Modern Physics, 14th Edition, Pearson Publication.

E-LEARNING RESOURCES:

1. https://nptel.ac.in/courses/115/103/115103101/
2. https://www.youtube.com/watch?v=1Fdr0P3BOjk&ab_channel=Ch-22Physics%5BIIT-PAL%5D
3. https://nptel.ac.in/content/storage2/courses/112101007/downloads/Lecturenotes/Lecture3.pdf
4. https://www.britannica.com/science/radioactivity/Occurrence-of-radioactivity
5. http://www.freebookcentre.net/Physics/Nuclear-Physics-Books.html

Mapping of CO with PSO:

CO / PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	S	S	M	M	S
CO2	S	S	S	S	S
CO3	S	M	M	S	S
CO4	S	S	S	S	S
CO5	S	M	S	M	S
Average	S	S	S	S	S

PEDAGOGY: Chalk and Talk, PPT, Lectures, Group discussions and seminars.

ELECTIVE THEORY PAPER- I SEMESTER V

MICROPROCESSOR – 8085

Subject code: 20UPHET5001 Total hours: 5
L-T-P: 5-0-0 Credit: 5

COURSE OBJECTIVES:

1. Understand the architecture and pin functions of 8085
2. Learn the complete instruction set of 8085
3. Learn the basics of 8 bit programming
4. Understand the concepts of interfacing, I/O and peripherals

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Understand the complete architecture of 8085
CO2	Acquire knowledge about microprocessor and organisation of microprocessor based system
CO3	Understand the interrupts and interfacing of I/O and other peripherals
CO4	Compare and analyse various instruction set of 8085 microprocessor
CO5	Apply the programming knowledge to solve /perform various new tasks/programming in assembly language

UNIT I: ARCHITECTURE **15 hrs**

Introduction to microprocessor - Pin functions of 8085 - Pin-out signal function diagram. Architecture of 8085 - register array - ALU and associated circuitry - Instruction register and decoder - Timing and control unit - Demultiplexing address/data bus. Microprocessor as CPU - system bus and bus structure - execution of an instruction - Programmer's model of 8085.

UNIT II: INSTRUCTION SET **15 hrs**

Instruction set of 8085 - Data transfer instructions - Arithmetic and logic instructions - Compare and rotate instructions - Branch and stack instructions - I/O and Machine control group of instructions. Assembly language to hex code. Addressing modes.

UNIT III: PROGRAMMING EXERCISE **15 hrs**

Assembly language and machine language - Programming exercises - addition, subtraction, Multiplication and division (all 8-bit binary) - ascending order/descending order.

UNIT IV: MEMORY AND I/O INTERFACE **15 hrs**

Introduction - Memory read and write machine cycles - Timing diagram for MOV B, A and MVI A, 25 instructions. Memory interface - generating control signals - Interfacing 2Kx8 EPROM and 2kx8 RAM interface. Interfacing input port and output port to 8085 - IN instruction and its timing diagram - Design of an input port - OUT instruction and its timing diagram - Design of an output port - Direct I/O and Memory mapped I/O.

UNIT V: INTERRUPTS AND PERIPHERAL DEVICE- 8255 **15 hrs**

Introduction - Interrupts in 8085 - hardware and software interrupts - RIM- SIM instructions - priorities. Programmable peripheral interface – 8255 - Block diagram and working - Interfacing 8255 to 8085 - LED interface - program for flashing LED's.

BOOKS FOR STUDY:

1. V. Vijayendran, 2009, Fundamentals of Microprocessor 8085, S.Viswanathan publishers, Chennai.
2. Ramesh Gaonkar, 2015, Microprocessor Architecture Programming and Application with 8085/8080A, Wiley Eastern.

BOOKS FOR REFERENCE:

1. Adithya Mathur, 1989, Introduction to Microprocessors Tata McGraw-Hill Education.
2. A.P. Godse & D.A. Godse, 2010, Microprocessors & Applications, 3rd edition , Technical Publications, Pune.
3. B. Ram, 2012, Fundamentals of Microprocessors and Microcontrollers, Dhanpat Raj publications.

4. M.Senthil_Kumar, M. Saravanan, and S. Jeevanathan, 2016, Microprocessors and Microcontrollers Oxford University Press.

E-LEARNING RESOURCES:

1. https://www.youtube.com/watch?v=AnfE2AlT-sU
2. https://www.javatpoint.com/programming-in-8085
3. https://technobyte.org/8085-8255-interfacing-tutorial/

4. https://www.geeksforgeeks.org/programmable-peripheral-interface-8255/

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	M	S	M
CO2	S	M	M	S	M
CO3	S	S	M	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S
Average	S	S	M	S	S

PEDAGOGY: Chalk and Talk, PPT, Lectures, Group discussions and seminars.

ELECTIVE PROJECT- I –SEMESTER V

Project

Subject code: 20UPHEP5001 Total hours: 5
L-T-P: 0-05 Credit: 5

COURSE OBJECTIVES:

1. Introduce the concept of research
2. Able to analyse the available literature and find a suitable research topic
3. Understand the various material synthesis methods and characterisation
4. To analyse the result and bring out conclusion
5. Able to write the project report

COURSE OUTCOMES:

CO1	Prepare comprehensive report based on the literature survey /topic related to different fields of physics
CO2	Able to synthesise the materials
CO3	Identify the applicability of modern software tools and characterization technique
CO4	Deliver presentation based on preparation
CO5	Answer queries posted by listeners

Mapping of CO with PSO:

CO / PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	S	M	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	M	M	M	M	M
CO5	S	M	S	S	S
Average	**S**	**M**	**S**	**S**	**S**

CORE PAPER XII SEMESTER VI

RELATIVITY AND QUANTUM MECHANICS

Subject code: 20UPHCT6012 Total hours: 7
L-T-P: 5-2-0 Credit: 4

COURSE OBJECTIVES:

1. To analyse and define the laws involved in relativity which are essential tools in problem solving
2. To discuss elementary ideas on wave nature of matter and will be able to write equation for real time problems using Schrodinger equation
3. To compute and evaluate the theoretical predictions for scattering theory

COURSE OUTCOMES:

CO No.	CO Statement
CO1	Demonstrate an understanding of the basic principles of Special and General theory of relativity and explain the true nature of Newtonian Mechanics and Lorentz Transformation equations. Further students are provided with an idea of relativity which are essential tools in problem solving
CO2	Explain the historical aspects of development of quantum mechanics and the differences between classical and quantum mechanics
CO3	Formulate the idea of wave function and interpret the fundamental concepts of uncertainty relations and to understand the fundamentals concepts in operator formalism
CO4	Evaluate the physical interpretation of wave function, analyze time dependent and independent Schrodinger wave equation devise it for simple potential well
CO5	The concepts of scattering theory, scattering amplitude, centre of mass frame and laboratory frame are explained in detail.

UNIT I: RELATIVITY **15 hrs**

Frame of reference - Galilean transformation - Michelson-Morley experiment - Postulates of special theory of relativity - Lorentz transformation - Length contraction - Time dilation - Relativity of simultaneity - Addition of velocities - Variation of mass with velocity - mass energy equation - Minkowski's four dimensional space - Space time continuum - Elementary ideas of general theory of relativity.

UNIT II: WAVE NATURE OF MATTER **15 hrs**

Dual nature of matter - De Broglie concept of matter waves - Expression for De Broglie wavelength - Phase and group velocity - Davisson and Germer's experiment - G.P. Thomson's experiment - Electron microscope - Heisenberg uncertainty principle – Illustration of Heisenberg uncertainty principle

UNIT III: SCHRODINGER EQUATIONS **15 hrs**

Inadequacy of Classical Mechanics - Basic postulates of Wave mechanics - Time dependent Schrodinger equation - Time independent Schrodinger equation - properties of wave function - operator formalism - Linear operators - Self-adjoint operators - Expectation value - Eigen value - Eigen values and Eigen functions -Commutativity and Compatibility.

UNIT IV: APPLICATION OF SCHRODINGER EQUATIONS **15 hrs**

Free particle solution of Schrodinger equation - particle in a box - Qualitative treatment (outlining steps only) of the Barrier penetration problem - Linear harmonic oscillator - Rigid rotator - Hydrogen atom.

UNIT V: SCATTERING THEORY **15 hrs**

Scattering process - Differential and total cross section - Scattering amplitude - Centre of mass frame - Laboratory frame - Reduced mass - Transformation from C.M. frame to laboratory frame - reduction of two body problem into one body problem.

BOOKS FOR STUDY:

1. R. Murugeshan, 2018, Modern Physics, S. Chand & Co. Ltd.
2. Robert Resnick, 2003, Introduction to Special theory of Relativity, John Wiley Eastern Ltd.
3. P. M. Mathews and Venkatesan, 2010, A Text Book of Quantum Mechanics, McGraw Hill Publishers.

BOOKS FOR REFERENCE:

1. Ghatak and Loganathan, 2004, Quantum Mechanics, Macmillan India Pvt. Ltd.
2. Beiser, 2017, Concepts of Modern Physics, 7th edition, Tata MC Graw Hill Publishers.
3. V. Devanathan, 2011, Quantum Mechanics, Narosa Publications.
4. A. Ghatak, 2002, Basic Quantum Mechanics, Macmillan Publishers.
5. Nordeine Zettili, John, 2001, Quantum Mechanics, Wiley Publishers.
6. D. Halliday, R. Resnick and J. Walker, 2001, Fundamentals of Physics, 6th edition, Wiley Publishers, New York.

E-LEARNING RESOURCES:

1. http://physics.mq.edu.au/~jcresser/Phys201/LectureNotes/SchrodingerEqn.pdf
2. https://www.space.com/36273-theory-special-relativity.html
3. https://byjus.com/jee/schrodinger-wave-equation/
4. https://qudev.phys.ethz.ch/phys4/PHYS4_lecture02v1_2page.pdf
5. https://galileo.phys.virginia.edu/classes/752.mf1i.spring03/ScatteringTheory.htm

Mapping of CO with PSO:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	S	M	S	S
CO3	S	S	M	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S
Average	S	S	S	S	S

PEDAGOGY: Chalk and Talk, PPT, Lectures, Group discussions and seminars.

CORE PAPER XIII SEMESTER VI

SOLID STATE PHYSICS

Subject code: 20UPHCT6013 Total hours: 7
L-T-P: 5-2-0 Credit: 4

COURSE OBJECTIVES:

1. To understand the types of solids and their classification.
2. To gain knowledge on magnetic properties of materials.
3. To study dielectric materials and superconductivity.

COURSE OUTCOMES:

CO No.	CO STATEMENT
CO1	Explains the basic theories of solid state structure and influence of crystal binding energy on crystalline structure.
CO2	Analyses the concepts of lattice, point and space groups, Be familiar with Bragg's Law and explain its relation to crystal structure
CO3	Discuss the basic concepts of force between atoms and bonding between molecules, Analyse the relationship between conductors, insulators and super conductivity
CO4	Identify the properties of matter and classifications of polarization
CO5	Predict to gain knowledge of superconductivity, its underlying principles and its applications in modern world

UNIT I: CRYSTAL STRUCTURE **15 hrs**

Crystal Lattice - Primitive and Unit cell - Seven classes of crystals - Bravais Lattice - Miller Indices - Structure of Crystals - Simple cubic, Face centered cubic structure, Body centered cubic structure, and Hexagonal closed packed structure, Diamond structure - Sodium Chloride structure - Zinc Blend structure.

UNIT II: DIFFRACTION OF X-RAYS BY CRYSTALS **15 hrs**

Diffraction of X-Rays by crystals - Bragg's Law in one Dimension - Experimental Method in X-Ray Diffraction - Rotating Crystal method - Concept of reciprocal lattice. Structure

analysis of Water molecule (bond length, bond angle, hydrogen bonds, and Vanderwaal's radii only).

UNIT III: MAGNETIC MATERIALS **15 hrs**

Different type of Magnetic materials - Para, dia, and ferromagnetic materials - Classical theory of Diamagnetism (Langevin's theory) - Weiss Theory of Para magnetism - Curie Weiss Law - Domain theory - Hysteresis.

UNIT IV: DIELECTRIC MATERIALS **15 hrs**

Fundamental definitions in Dielectrics - Different types of electric polarization - Frequency and temperature effects on polarization - Dielectric loss - Clausius-Mosotti Relation - Determination of dielectric constants - Applications of dielectric materials.

UNIT V: SUPERCONDUCTIVITY **15 hrs**

Introduction -Temperature dependence of resistivity in super conducting material - Effect of magnetic field (Meissner effect) - Temperature dependence of critical field - Type I and Type II Superconductors - BCS Theory (qualitative) - High temperature Superconductors - Applications of Superconductors.

BOOKS FOR STUDY:

1. M. Ali Omar, 1999, Elementary Solid State Physics, Pearson India Publishing.
2. M.A. Wahab, 2011, Solid State Physics, Narosa Publications.
3. P.K. Palanisamy, August 2011, Solid state physics, Scitech Publications (India) Pvt Ltd.
4. R Murugeshan, Kiruthiga Sivaprasath, January 2016, Modern Physics, S Chand Publisher.
5. S.O.Pillai, 2020, Solid state physics, New Age International Publishing.

BOOKS FOR REFERENCE:

1. V. Raghavan, 2004, Material Science and Engineering PHI Publishing.
2. Beiser, 1997, 5th Edition, Concepts of Modern Physics, Tata Mc. Graw Hill.
3. David Halliday, Robert Resnick, Jearl Walker, e-book, 2018, Fundamentals of Physics: Extended, 11th Edition, Wiley.
4. R.G Sharma, October 2016, Superconductivity: Basics and Applications to Magnets: 214 (Springer Series in Materials Science) Paperback, Springer.
5. M.A. Omar, 2002, Elementary Solid State Physics, Pearson Education.

E-LEARNING RESOURCES:

1. https://www.drdo.gov.in/labs-and-establishments/solid-state-physics-laboratory-sspl
2. https://www.sciencedirect.com/bookseries/solid-state-physics
3. https://www.springer.com/gp/book/9783662499948
4. https://www.e-booksdirectory.com/listing.php?category=403
5. https://en.wikipedia.org/wiki/Solid-state_physics
6. https://byjus.com/physics/solid-state-physics/

Mapping of CO with PSO:

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S
Average	S	S	S	S	S

PEDAGOGY: Chalk and Talk, PPT, Lectures, Group discussions and seminars

CORE PAPER XIV SEMESTER VI

INTEGRATED ELECTRONICS

Subject code: 20UPHCT6014 Total hours: 7
L-T-P: 5-2-0 Credit: 4

COURSE OBJECTIVES:

1. Use the basic logic gates and various reduction techniques of digital logic circuit in detail.
2. Design combinational and sequential circuits.
3. To understand the basic concepts of operational amplifier and its various applications.
4. To know about various analog switches and different A/D and D/A convertors.

COURSE OUTCOMES:

CO No.	CO STATEMENT
CO1	Explain the structure of various number systems and its applications in digital design.
CO2	Apply the Karnaugh Map to simplify Boolean equation and draw a simplified circuit
CO3	Design operational amplifier circuits and to analyse their properties
CO4	Acquire knowledge about the internal circuitry and logic behind any digital system
CO5	Analyse and construct various digital circuits like flip flops, shift registers and counters

UNIT I: FUNDAMENTAL DIGITAL ELECTRONICS 15 hrs

Number Sytem: Binary number system - Hexadecimal number system - Decimal to hex conversion - Hex to decimal conversion - Binary coded decimal.

Logic gates: AND, OR, NOT and Exclusive OR gates - De Morgan's theorems- NAND and NOR as universal logic gates. Sum of Product method and Product of Sums. Boolean algebra - Simplification of logic expressions using Boolean algebra and Karnaugh map method - pair, quad and octet - Two, three and four variable K map - Don’t care conditions.

UNIT II: ARITHMETIC CIRCUITS **15 hrs**

Half adder, full adder, half subtractor and full subtractor – 4 bit adder/subtractor.

Multiplexer (MUX) -4 to 1 MUX - Demultiplexer (DMUX)- 1 to 4 DMUX- Decoder -3 to 8 decoder- Encoder- 8 to 3 encoder.

UNIT III: SEQUENTIAL LOGIC CIRCUITS **15 hrs**

Flip flop: NAND Latch - RS flip flop-Edge triggered RS Flip Flop, D and T Flip Flop - JK flip flops - JK Master Slave flip flop.

Counters: Asynchronous/ ripple counters - Modulus counters using feedback technique - Up counter - Down counter - Up/down counter - Mod 10/BCD counter.

Synchronous counter - K map design.

Registers: Shift registers - Shift left, Shift right registers and shift left- shift right registers - Ring counter - Johnson's counter using flipflops.

UNIT IV: OP-AMP **15 hrs**

Op-amp: Pin configuration of Op-amp - Characteristics and parameters of Op-amp.

Basic Op-amp circuits: Inverter, non-inverter, summing and averaging- subtractor- voltage follower, integrator, differentiator, comparator.

Wave form generators: Sinewave oscillators-Phase Shift and Wein Bridge Oscillators.

UNIT V: MULTIVIBRATOR, DAC AND ADC CIRCUITS **15 hrs**

Timer 555: Pin configuration of 555 timer- Internal block diagram and working -555 timer as schmitt trigger- 555 timer as astable multivibrator and monostable multivibrator.

DAC and ADC using Op-amp: Digital to Analog (D/A) converter - binary weighted resistor method - D/A accuracy and resolution - R-2R ladder method - Analog to Digital (A/D) converter - successive approximation method.

BOOKS FOR STUDY:

1. V.Vijayendran, S. Viswanathan, (2009). Introduction to Integrated Electronics. (Printers and Publishers) Pvt. Ltd., Chennai

2. Malvino Leach, (1992). Digital Principles and Application. 4th Edition. Tata McGraw Hill.

3. Thomas L. Floyd, (1998). Digital Fundamentals Universal Book Stall, New Delhi.

4. Ramakant A. Gayakwad, (1994). OP - AMPs and Linear Integrated Circuits Prentice Hall of India

BOOKS FOR REFERENCE:

1. J.Millman and C.Halkias, (2001). Integrated Electronics. Tata McGraw Hill, New Delhi

2. R.P.Jain - (1996). Digital Electronics by Practice Using Integrated Circuits. Tata McGraw Hill

3. Roy Choudhury D. and Shail Jain. (2003). Linear Integrated Circuits New Age International (P) Ltd

4. Nagrath I.J. - (1999) Electronics - Analog and Digital Prentice - Hall of India, New Delhi.

E-LEARNING RESOURCES:

1. https://www.youtube.com/watch?v=wjM2RDG5yTI

2. https://www.youtube.com/watch?v=QWMpq6NLwF4

3. https://nptel.ac.in/courses/117/107/117107094/

4. http://www.infocobuild.com/education/audio-video-courses/electronics/BasicElectronics-Patil-IIT-Bombay/lecture-69.html

5. https://www.youtube.com/watch?v=wa7pIviT-do

Mapping of CO with PSO:

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	S	M	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	M	S
CO5	S	S	S	S	S
Average	S	S	S	S	S

PEDAGOGY: Chalk and Talk, PPT, Lectures, Group discussions and seminars

CORE MAJOR PRACTICALS - III

Subject code: 20UPHCP6003 Semester: VI
Int. mark: 40 Credit: 2
Ext. mark: 60 L-T-P: 0-0-2

COURSE OBJECTIVES:

1. Understand the concept of elasticity , interference, dispersion, magnetic induction
2. Understand the principle of potentiometer
3. Understand the concept of ballistic galvanometer and Laser

COURSE OUTCOMES:

CO No.	CO STATEMENT
CO1	Apply the knowledge of elasticity to evaluate the Young's Modulus of the material
CO2	Able to compute the values of refractive index, dispersive power and Cauchy's constant
CO3	Demonstrate the calibration of high range voltmeter and compare the emf of given cells using potentiometer

ANY FIFTEEN EXPERIMENTS ONLY

1. Young's Modulus-Koenig's method- Non-uniform bending..
2. Newton's rings-R_1,R_2 and μ
3. Spectrometer- i-i' curve.
4. Spectrometer-Dispersive power of a prism.
5. Spectrometer-Calculation of Cauchy's constant using software.
6. Spectrometer-Narrow angled prism.
7. Field along the axis of a circular coil-Deflection magnetometer-B_H and M.
8. Field along the axis of a circular coil-Vibration Magnetic needle-B_H.
9. EMF of a thermocouple-Mirror galvanometer(or table galvanometer)
10. Potentiometer-EMF of a thermocouple
11. Potentiometer-Calibration of high range voltmeter.
12. Potentiometer- Comparisons of EMFs.

13. Potentiometer-Internal resistance of a cell.
14. Conversion of a milli ammeter into a voltmeter & ammeter of various ranges and ohmmeter.
15. B.G.-Figure of merit(for charge)
16. B.G.-Comparison of capacitances.
17. B.G.-Absolute capacitance of a capacitor.
18. B.G.-Comparison of mutual inductances.
19. B.G.-Absolute mutual inductance.
20. B.G.-Comparisons of EMFs.
21. B.G.-Internal resistance of a cell.
22. Bridge rectifier-Zener regulator power supply-9V-Regulating characteristics.
23. Determination of Wavelength of the Laser source

BOOKS FOR STUDY AND REFERENCES:

1. B.P. Khandalwal, A Laboratory manual of Physics for U.G. Courses.
2. M.N Srinivasan, 2011, A Text Book of Practical Physics, S. Chand&co.
3. M. Arul Thalapathi Practical Physics, Comptek publishers.

Mapping of CO with PSO:

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
Average	S	S	S	S	S

CORE MAJOR PRACTICALS - IV

Subject code: 20UPHCP6004 Semester: VI
Int. mark: 40 Credit: 2
Ext. mark: 60 L-T-P: 0-0-2

COURSE OBJECTIVES:

1. Understand the concept of bridge rectifier, oscillators, multiplexer/de- multiplexer etc
2. Gain knowledge clipping and clamping, differentiator and integrator circuts etc
3. Analyze the functions of counters and registers

COURSE OUTCOMES:

CO No.	CO STATEMENT
CO1	Able to construct bridge rectifier various oscillator circuits
CO2	Demonstrate the universal logic gates
CO3	Compare the operations of oscillators, counters and registers

ANY FIFTEEN EXPERIMENTS

1. Bridge rectifier-Zener regulator power supply-9V-Regulating characteristics.
2. Harley Oscillator
3. Colpitt's Oscillator
4. Phase shift Oscillator
5. Clipping and clamping circuits.
6. Differentiating and Integrating circuits.
7. Transistor-astable multivibrator.
8. OpAmp-inverting amplifier,Non-inverting amplifier and unity follower.
9. NAND and NOR as universal gates.
10. Half adder and Full adder.
11. Half subtractor and Full subtractor.
12. Study of Multiplexers and Demultiplexers.
13. 4-bit ripple counter using 7473/7476
14. 4-bit shift register using 7473/7476
15. Decade counter 7490.
16. Study of J K flip flop&D flip flop

17. Study of R S flip flop
18. Schmitt trigger-555 timer/op amp

BOOKS FOR STUDY AND REFERENCES:

1. B.P. Khandalwal, A Laboratory manual of Physics for U.G. Courses.
2. Worsnop and Flint, Advanced Practical Physics.
3. M.N Srinivasan, 2011, A Text Book of Practical Physics, S. Chand&co.
4. M. Arul Thalapathi, Practical Physics by, Comptek publishers.

Mapping of CO with PSO:

CO / PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
Average	S	S	S	S	S

CORE ELECTIVE PRACTICALS - I

Subject code: 20UPHEP6001 Semester: VI
Int. mark: 25 Credit: 5
Ext. mark: 75 L-T-P: 0-0-2

COURSE OBJECTIVES:

1. Gain knowledge on the instruction sets of 8085
2. Understand the concept of 8-bit programming
3. Gain knowledge on operational amplifiers, 555 timer etc

COURSE OUTCOMES:

CO No.	CO STATEMENT
CO1	Apply the knowledge to write the various 8-bit programs
CO2	Sort out and rectify the errors in programming
CO3	Construct and analyse summing and difference amplifier, differentiating and integrating circuits and various oscillators

ANY FIFTEEN EXPERIMENTS

1. Microprocessor –8085 – 8 bit Addition
2. Microprocessor – 8085 – 8 bit Subtraction
3. Microprocessor – 8085 – 8 bit Multiplication
4. Microprocessor – 8085 – 8 bit Division
5. Microprocessor – 8085 – Addition of N Number of single byte numbers
6. Microprocessor – 8085 – Sorting of given set of numbers in ascending order
7. Microprocessor – 8085 – Sorting of given set of numbers in descending order
8. Microprocessor – 8085 – Finding the largest no. in a given set of numbers.
9. Microprocessor– 8085–Finding the smallest no. in a given set of numbers.
10. Op amp 741 - Inverting, Non - Inverting amplifier, unity follower.
11. Op amp 741 - Summing and difference amplifier
12. Op amp 741 – Differentiator, integrator
13. OP amp 741 – Solving simultaneous equations
14. Op amp 741 – Wein's Bridge oscillator
15. Op amp 741 - Phase Shift oscillator

16. 555 - Timer - Schmitt Trigger
17. 555 - Timer - Astable operation
18. 555 - Timer - Monostable
19. D/A Converter – 4 bit, binary weighted resistor method
20. Op-Amp-741 Astable multivibrator
21. Demonstrative Experiment-Microcontroller-8051-8 bit Addition and Subtraction.

BOOKS FOR STUDY AND REFERENCE:

1. D. Chattopadhyay, P.C. Rakshit, 2007 Practical Physics, New Central Book Agency (p) Ltd. Kolkata.
2. C.C.Ouseph, U.J.Rao and Vijayendran, 2007, Practical Physics and Electronics, S.Viswanathan Printers & Publishers Pvt., Ltd.
3. C L Arora, 2008, Practical Physics, S. Chand & Co., New Delhi.

Mapping of CO with PSO:

CO / PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	M	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
Average	S	S	S	S	S