	Government College (Autonomous) Rajahmundry	Program & Semester I B.Sc., (I SEM)			
Course Code 124901	ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Trigonometric ratios, vector multiplication, Laws of motion, Basics of thermodynamics, kepler's laws, Inverse square law, Periodic table, classification matter	3	0	2	4

Course Objective:

The objective of this course is to provide students with a comprehensive understanding of the essential concepts and applications of mathematical, physical, and chemical sciences. The course aims to develop students' critical thinking, problem-solving, and analytical skills in these areas, enabling them to apply scientific principles to real-world situations.

Learning outcomes:

	On Completion of the course, the students will be able to-	Cognitive Domain
CO1	Apply critical thinking skills to solve complex problems involving complex numbers, trigonometric ratios, vectors, and statistical measures.	Understanding & Application
CO2	To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations	Application
CO3	To Explain the basic principles and concepts underlying a broad range of fundamental areas of chemistry and to Connect their knowledge of chemistry to daily life.	Understanding , Application
CO4	Understand the interplay and connections between mathematics, physics, and chemistry in various applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.	understanding , Applicatsion
CO5	To explore the history and evolution of the Internet and to gain an understanding of network security concepts, including threats, vulnerabilities, and countermeasures	Application



COURSE 1: ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

UNIT I: ESSENTIALS OF MATHEMATICS:

Complex Numbers: Introduction of the new symbol i – General form of a complex number – Modulus-Amplitude form and conversions

Trigonometric Ratios: Trigonometric Ratios and their relations – Problems on calculation of angles

Vectors: Definition of vector addition – Cartesian form – Scalar and vector product and problems

Statistical Measures: Mean, Median, Mode of a data and problems

UNIT II: ESSENTIALS OF PHYSICS:

Definition and Scope of Physics- Measurements and Units - Motion of objects: Newtonian Mechanics and relativistic mechanics perspective - Laws of Thermodynamics and Significance- Acoustic waves and electromagnetic waves- Electric and Magnetic fields and their interactions- Behavior of atomic and nuclear particles- Wave-particle duality, the uncertainty principle- Theories and understanding of universe

UNIT III: ESSENTIALS OF CHEMISTRY::

Definition and Scope of Chemistry- Importance of Chemistry in daily life -Branches of chemistry and significance- Periodic Table- Electronic Configuration, chemical changes, classification of matter, Biomolecules- carbohydrates, proteins, fats and vitamins.

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY:

Applications of Mathematics in Physics & Chemistry: Calculus, Differential Equations & Complex Analysis

Application of Physics in Industry and Technology: Electronics and Semiconductor Industry, Robotics and Automation, Automotive and Aerospace Industries, Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies.

Application of Chemistry in Industry and Technology: Chemical Manufacturing, Pharmaceuticals and Drug Discovery, Materials Science, Food and Beverage Industry.

UNIT V: ESSENTIALS OF COMPUTER SCIENCE:

Milestones of computer evolution - Internet, history, Internet Service Providers, Types of Networks, IP, Domain Name Services, applications.

Ethical and social implications: Network and security concepts- Information Assurance Fundamentals, Cryptography-Symmetric and Asymmetric, Malware, Firewalls, Fraud Techniques- Privacy and Data Protection

Recommended books:


1. Functions of one complex variable by John.B.Conway, Springer- Verlag.
2. Elementary Trigonometry by H.S.Hall and S.R.Knight
3. Vector Algebra by A.R.Vasishtha, Krishna Prakashan Media(P)Ltd.
4. Basic Statistics by B.L.Agarwal, New age international Publishers
5. University Physics with Modern Physics by Hugh D. Young and Roger A. Freedman
6. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker

7. "Physics for Scientists and Engineers with Modern Physics" by Raymond A. Serway and John W. Jewett Jr.
8. "Physics for Technology and Engineering" by John Bird
9. "Chemistry in daily life" by Kirpal Singh
10. "Chemistry of bio molecules" by S. P. Bhutan
11. "Fundamentals of Computers" by V. RajaRaman
12. "Cyber Security Essentials" by James Graham, Richard Howard, Ryan Olson

vv CO-PO Mapping:

(1: Slight [Low];
2: Moderate [Medium]; 3: Substantial [High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	1	2	2	3	1	2	1	1	3	2	3	2	2	3	2
CO2	2	1	2	1	2	2	1	2	2	2	2	2	2	1	2	2
CO3	2	1	2	2	3	2	1	2	2	2	2	3	2	1	3	2
CO4	3	2	2	2	3	3	1	3	3	2	2	3	2	1	3	3
CO5	2	1	2	3	2	2	2	2	2	1	2	2	3	2	2	2

	Government College (Autonomous) Rajahmundry	Program & Semester I B.Sc.(I SEM)			
Course 2 124902	ADVANCES OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES				
Teaching	Hours Allocated:60 (Theory)	L	T	P	C
Pre-requisites:	Basic knowledge of geometry, matrices, law of conservation of energy, Number system etc.	3	0	2	4

Course Objective:

The objective of this course is to provide students with an in-depth understanding of the recent advances and cutting-edge research in mathematical, physical, and chemical sciences. The course aims to broaden students' knowledge beyond the foundational concepts and expose them to the latest developments in these disciplines, fostering critical thinking, research skills, and the ability to contribute to scientific advancements.

Learning outcomes:

	On Completion of the course, the students will be able to-	Cognitive Domain
CO1	Explore the applications of mathematics in various fields of physics and chemistry, to understand how mathematical concepts are used to model and solve real-world problems.	Understanding & Application
CO2	To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations.	Application
CO3	Understand the different sources of renewable energy and their generation processes and advances in Nanomaterials and their properties, with a focus on quantum dots. To study the emerging field of quantum communication and its potential applications. To gain an understanding of the principles of biophysics in studying biological systems. Explore the properties and applications of shape memory materials.	Understanding , Application
CO4	Understand the principles and techniques used in computer-aided drug design and drug delivery systems, to understand the fabrication techniques and working principles of Nano sensors. Explore the effects of chemical pollutants on ecosystems and human health.	understanding , Application
CO5	Understand the interplay and connections between mathematics, physics, and chemistry in various advanced applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.	Application

SYLLABUS :

UNIT I: ADVANCES IN BASICS MATHEMATICS

Straight Lines: Different forms – Reduction of general equation into various forms – Point of intersection of two straight lines

Limits and Differentiation: Standard limits – Derivative of a function – Problems on product rule and quotient rule

Integration: Integration as a reverse process of differentiation – Basic methods of integration

Matrices: Types of matrices – Scalar multiple of a matrix – Multiplication of matrices – Transpose of a matrix and determinants

UNIT II: ADVANCES IN PHYSICS:

Renewable energy: Generation, energy storage, and energy-efficient materials and devices. **Recent advances in the field of nanotechnology:** Quantum dots, Quantum Communication- recent advances in biophysics- recent advances in medical physics- Shape Memory Materials.

UNIT III: ADVANCES IN CHEMISTRY:

Computer aided drug design and delivery, nano sensors, Chemical Biology, impact of chemical pollutants on ecosystems and human health, Dye removal - Catalysis method

UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY


- **Mathematical Modelling applications in physics and chemistry**
 - **Application of Renewable energy:** Grid Integration and Smart Grids,
 - **Application of nanotechnology:** Nanomedicine,
 - **Application of biophysics:** Biophysical Imaging, Biomechanics, Neurophysics,
 - **Application of medical physics:** Radiation Therapy, Nuclear medicine
- Solid waste management, Environmental remediation- Green Technology, Water treatment.

UNIT V: Advanced Applications of computer Science

Number System-Binary, Octal, decimal, and Hexadecimal, Signals-Analog, Digital, Modem, Codec, Multiplexing, Transmission media, error detection and correction- Parity check and CRC, Networking devices- Repeater, hub, bridge, switch, router, gateway.

Recommended books:

1. Coordinate Geometry by S.L.Lony, Arihant Publications
2. Calculus by Thomas and Finny, Pearson Publications
3. Matrices by A.R.Vasishtha and A.K.Vasishtha, Krishna Prakashan Media(P)Ltd.
4. "Renewable Energy: Power for a Sustainable Future" by Godfrey Boyle
5. "Energy Storage: A Nontechnical Guide" by Richard Baxter
6. "Nanotechnology: Principles and Applications" by Sulabha K. Kulkarni and Raghvendra A. Bohara
7. "Biophysics: An Introduction" by Rodney Cotterill
8. "Medical Physics: Imaging" by James G. Webster
9. "Shape Memory Alloys: Properties and Applications" by Dimitris C. Lagoudas
10. Nano materials and applications by M.N.Borah
11. Environmental Chemistry by Anil.K.D.E.
12. Digital Logic Design by Morris Mano
13. Data Communication & Networking by Bahrouz Forouzan.

	Government College (Autonomous) Rajahmundry	Program & Semester I B.Sc.(II Sem)			
Course 3 224901	MECHANICS AND PROPERTIES OF MATTER				
Teaching	Hours Allocated:60 (Theory)	L	T	P	C
Pre-requisites:	Laws of motion, vector and scalar concepts, rotator motion, basic mathematical laws	3	0	-	4

Course Objective:

The course on Mechanics and Properties of Matter aims to provide students with a fundamental understanding of the behaviour of physical systems, both in terms of mechanical motion and in terms of the properties of matter

Course Outcomes:

On Completion of the course, the students will be able to-

Cognitive Domain

CO1 Students will be able to understand and apply the concepts of scalar and vector fields, calculate the gradient of a scalar field, determine the divergence and curl of a vector field. **Understanding & Application**

CO2 Students will be able to apply the laws of motion, solve equations of motion for variable mass systems **Application**

CO3 Students will be able to define a rigid body and comprehend rotational kinematic relations, derive equations of motion for rotating bodies, analyze the precession of a top and gyroscope, understand the precession of the equinoxes **Understanding , Application**

CO4 Students will be able to define central forces and provide examples, understand the characteristics and conservative nature of central forces, derive equations of motion under central forces. **understanding , Application**

CO5 Students will be able to differentiate between Galilean relativity and the concept of absolute frames, comprehend the postulates of the special theory of relativity, apply Lorentz transformations, understand and solve

problems

Application

Course with focus on employability/entrepreneurship/Skill Development modules

Skill Developmen t		Employability		Entrepreneurship	
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SYLLABUS:

UNIT-I VECTOR ANALYSIS

Scalar and vector fields, gradient of a scalar field and its physical significance. Divergence and curl of a vector field with derivations and physical interpretation. Vector integration (line, surface and volume), Statement and proof of Gauss and Stokes theorems.

UNIT-II MECHANICS OF PARTICLES

Laws of motion, motion of variable mass system, Equation of motion of a rocket. Conservation of energy and momentum, Collisions in two and three dimensions, Concept of impact parameter, scattering cross-section, Rutherford scattering-derivation.

UNIT-III MECHANICS OF RIGID BODIES AND CONTINUOUS MEDIA

Definition of rigid body, rotational kinematic relations, equation of motion for a rotating body, Precession of a top, Gyroscope, Precession of the equinoxes. Elastic constants of isotropic solids and their relations, Poisson's ratio and expression for Poisson's ratio. Classification of beams, types of bending, point load, distributed load.

UNIT-IV CENTRAL FORCES

Central forces, definition and examples, characteristics of central forces, conservative nature of central forces, conservative force as a negative gradient of potential energy, equations of motion under a . Derivation of Kepler's laws. Motion of satellites

UNIT-V SPECIAL THEORY OF RELATIVITY

Galilean relativity, Absolute frames. Michelson-Morley experiment, The negative result. Postulates of special theory of relativity. Lorentz transformation, time dilation, length contraction, addition of velocities, mass-energy relation.

REFERENCE BOOKS:

1. BSc Physics -Telugu Akademy, Hyderabad
2. Mechanics - D.S. Mathur, Sulthan Chand & Co, New Delhi
3. Mechanics - J.C. Upadhyaya, Ramprasad & Co., Agra
4. Properties of Matter - D.S. Mathur, S.Chand & Co, New Delhi ,11th Edn., 2000
5. Physics Vol. I - Resnick-Halliday-Krane ,Wiley, 2001
6. Properties of Matter – Brijlal & Subrmanyam, S. Chand &Co. 1982
7. Dynamics of Particles and Rigid bodies– Anil Rao, Cambridge Univ Press, 2006
8. Mechanics-EM Purcell, Mc Graw Hill
9. University Physics-FW Sears, MW Zemansky & HD Young, Narosa Publications, Delhi


10. College Physics-I. T. Bhima sankaram and G. Prasad. Himalaya Publishing House.

11. Mechanics, S. G. Venkata chalapathy, Margham Publication, 2003.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	3	3	1	2	2	3	2	3	2	3	2	2
CO2	3	2	3	3	2	3	3	1	3	3	3	2	1	3	1	3
CO3	2	3	2	3	2	3	2	2	2	3	2	2	3	2	2	1
CO4	3	2	3	2	2	2	3	3	1	1	3	1	2	2	2	3
CO5	3	2	3	2	2	2	3	3	1	1	3	1	2	3	2	2

	Government College(Autonomous) Rajahmundry	Program & Semester I B.Sc. (II Sem)			
Course Code 224901	MECHANICS AND PROPERTIES OF MATTER (LAB)				
Teaching	Hours Allocated:30 (Practicals)	L	T	P	C
Pre-requisites:	Basic knowledge of screw gauge, vernier caliparse, travelling microscope	0	0	2	1

COURSE OBJECTIVE:


To develop practical skills in the use of laboratory equipment and experimental techniques for measuring properties of matter and analyzing mechanical systems.

LEARNING OUTCOMES:

1. Mastery of experimental techniques: Students should become proficient in using laboratory equipment and experimental techniques to measure properties of matter and analyze mechanical systems.
2. Application of theory to practice: Students should be able to apply theoretical concepts learned in lectures to real-world situations, and understand the limitations of theoretical models.
3. Accurate recording and analysis of data: Students should be able to accurately record and analyze experimental data, including understanding the significance of error analysis and statistical methods.
4. Critical thinking and problem solving: Students should be able to identify sources of error, troubleshoot experimental problems, and develop critical thinking skills in experimental design and analysis.
5. Understanding of physical principles: Students should develop an understanding of the physical principles governing mechanical systems and the properties of matter, including elasticity, viscosity, and thermal expansion.

Minimum of 6 experiments to be done and recorded

1. Viscosity of liquid by the flow method (Poiseuille's method)
2. Young's modulus of the material of a bar (scale) by uniform bending
3. Young's modulus of the material a bar (scale) by non- uniform bending
4. Surface tension of a liquid by capillary rise method
5. Determination of radius of capillary tube by Hg thread method
6. Viscosity of liquid by Searle's viscometer method
7. Bifilar suspension –moment of inertia of a regular rectangular body.
8. Determination of moment of inertia using Fly-wheel
9. Determination of the height of a building using a sextant.
10. Rigidity modulus of material of a wire-dynamic method (torsional pendulum)

	Government College (Autonomous) Rajahmundry	Program & Semester IB.Sc. (IISem)			
Course 4 224902	WAVES AND OSCILLATIONS				
Teaching	Hours Allocated (Theory)	L	T	P	C
Pre-requisites:	Basic idea of SHM, longitudinal and transverse waves and their parameters etc.	3	-	-	3

Course Objectives:

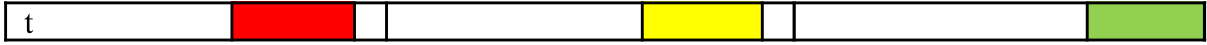
This course provides students with a broad understanding of the physical principles of the oscillations, to help them develop critical thinking and quantitative reasoning skills, to empower them to think creatively and critically about scientific problems and experiments.

Course Outcomes:

	On Completion of the course, the students will be able to-	Cognitive Domain
CO1 CO2 CO3 CO4	Student should be able to describe the basic characteristics of waves such as frequency, wavelength, amplitude, period, and speed	Understanding & Application
CO5	Student should be able to utilize mathematical relationships related to wave characteristics	Understanding , Application
	Student should be able to compare particle motion and wave motion in different types of waves	Application
	Student should be able to distinguish between Longitudinal and Transverse waves	
	Student should be able to get the knowledge about how to construct and analysis the square waves, saw tooth waves, etc. from Fourier analysis	

Course with focus on employability/entrepreneurship/Skill Development modules

Skill Development		Employability		Entrepreneurship	
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SYLLABUS:

UNIT-I Simple Harmonic oscillations

Simple harmonic oscillator and solution of the differential equation-Physical characteristics of SHM, torsion pendulum-measurements of rigidity modulus, compound pendulum- measurement of „g“, Principle of superposition, beats, combination of two mutually perpendicular simple harmonic vibrations of same frequency and different frequencies. Lissajous figures.

UNIT-II Damped and forced oscillations

Damped harmonic oscillator, solution of the differential equation of damped oscillator. Energy considerations, comparison with un-damped harmonic oscillator, logarithmic decrement, relaxation time, quality factor, differential equation of forced oscillator and its solution, amplitude resonance and velocity resonance.

UNIT-III Complex vibrations

9hr

Fourier theorem and evaluation of the Fourier coefficients, analysis of periodic wave functions-square wave, triangular wave, saw tooth wave, simple problems on evolution of Fourier coefficients.

UNIT-IV Vibrating Strings and Bars

Transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretched string clamped at ends, overtones and harmonics.

Energy


transport and transverse impedance. Longitudinal vibrations in bars-wave equation and its general solution. Special cases (i) bar fixed at both ends (ii) bar fixed at the midpoint (iii) bar fixed at one end. Tuning fork.

UNIT-V Ultrasonics:

Ultrasonics, properties of ultrasonic waves, production of ultrasonics by piezoelectric and magnetostrictive methods, detection of ultrasonics, determination of wavelength of ultrasonic waves. Applications and uses of ultrasonic waves.

REFERENCE BOOKS:

1. BSc Physics Vol.1, Telugu Academy, Hyderabad.
2. Fundamentals of Physics. Halliday/Resnick/Walker , Wiley India Edition 2007.
3. Waves & Oscillations. S.Badami, V. Balasubramanian and K.R. Reddy, Orient Longman.
4. College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House.
5. Science and Technology of Ultrasonics- Baldevraj, Narosa, New Delhi,2004
6. Introduction to Physics for Scientists and Engineers. F.J. Buche. McGraw Hill.

	Government College(Autonomous) Rajahmundry	Program & Semester I B.Sc. (II Sem)			
Course 4 224902	Waves and Oscillations (LAB)				
Teaching	Hours Allocated: 2hrs/week (Practicals)	L	T	P	C
Pre-requisites:	Usage of screwgauge, travelling microscope, idea of least count, knowledge about tuning forks etc	0	0	2	1

COURSE OBJECTIVE:


This course provides students with a broad understanding of the physical principles of the oscillations, to help them develop critical thinking and quantitative reasoning skills, to empower them to think creatively and critically about scientific problems and experiments.

LEARNING OUTCOMES:

1. Students are made to determine the unknown frequency of tuning fork by volume resonator experiment
2. Students are made to determine „g“ by compound/bar pendulum
3. Students are made to determine the force constant of a spring by static and dynamic method.
4. Students are made to determine the elastic constants of the material of a flat spiral spring.
5. Students are made to verify the laws of vibrations of stretched string –sonometer
6. Students are made to determine the frequency of a bar –Melde’s experiment.
7. Students are made to study the damped oscillation using the torsional pendulum immersed in liquid-decay constant and damping correction of the amplitude.
8. Students are made to form Lissajous figures using CRO.

Minimum of 6 experiments to be done and recorded Experiments

1. Volume resonator experiment
2. Determination of „g“ by compound/bar pendulum
3. Simple pendulum normal distribution of errors-estimation of time period and the error of the mean by statistical analysis
4. Determination of the force constant of a spring by static and dynamic method.
5. Determination of the elastic constants of the material of a flat spiral spring.
6. Coupled oscillators
7. Verification of laws of vibrations of stretched string –sonometer
8. Determination of frequency of a bar –Melde’s experiment.
9. Study of a damped oscillation using the torsional pendulum immersed in liquid-decay constant and damping correction of the amplitude.
10. Formation of Lissajous figures using CRO.

	Government College (Autonomous) Rajahmundry	Program & Semester IB.Sc. (IISem)			
Course Code 324901	WAVE OPTICS				
Teaching	Hours Allocated: 3 hrs/week (Theory)	L	T	P	C
Pre-requisites:	Wave equation solutions, Geometrical identities, Classification of theories of light, Image formation With mirrors and lenses, Properties of light.	3	-	-	3

Course Objectives:

- The phenomenon of interference of light and its formation in (i) Lloyd's single mirror due to Division of wave front and (ii) Thin films, Newton's rings and Michelson interferometer due to division of amplitude.
- Distinguish between Fresnel's diffraction and Fraunhofer diffraction and observe the diffraction patterns in the case of single slit and the diffraction grating.
- Describe the construction and working of zone plate and make the comparison of zone plate with convex lens.
- Comprehend the basic principle of laser, the working of He-Ne laser and Ruby lasers and their applications in different fields.
- Explain about the different aberrations in lenses and discuss the methods of minimizing them.
- Understand the basic principles of fiber optic communication and explore the field of Holography and Nonlinear optics and their applications.

Course Outcomes:

	On Completion of the course, the students will be able to-	Cognitive Domain
CO1	Students would learn about principle of superposition, coherence, Interference by division of wave front and amplitude, Fresnel's bi-prism, Lloyd's mirror, thin film interference, wedge shaped film interference, Newton's rings, Michelson's interferometer and their applications to sodium D lines and thickness of thin film.	Understanding & Application
CO2	Students would learn about Fresnel and Fraunhofer diffraction, Fraunhofer diffraction due to circular aperture, single slit, and double slit, N-slit, grating. They would also learn about Fresnel's half period zones, zone plate, phase reversal zone plates, comparison of zone plate & convex lens, interference & diffraction.	Application
CO3	Students would learn about methods of polarization, Brewster's law, Malus law, Nicol prism, Quarter wave plate, half wave plate,abinet's compensator and optical activity analysis by Laurent's half shade polarimeter.	Understanding , Application
CO4	Students would learn about various monochromatic and chromatic aberrations and their removal techniques. They would also learn about fiber optic types and applications	understanding , Application
CO5	Students would learn about principles of LASER, He-Ne laser, Ruby laser, applications of laser, Principles of optical fiber communication, classification of optical fibers, applications of optical fibers, principles of holography, limitations of Gabor's hologram and applications of holography	Application

SYLLABUS:**UNIT-I Aberrations**

Introduction – monochromatic aberrations, spherical aberration, methods of minimizing spherical aberration, coma, astigmatism and curvature of field, distortion. Chromatic aberration-the achromatic doublet. Achromatism for two lenses (i) in contact and (ii) separated by a distance.

UNIT-II Interference

Principle of superposition – coherence Conditions for interference of light. Fresnel's biprism determination of wavelength of light –change of phase on reflection. Oblique incidence of a plane wave on a thin film due to reflected light (cosine law) –colors of thin films- Interference by a film with two non-parallel reflecting surfaces (Wedge shaped film). Determination of diameter of wire, Newton's rings in reflected light. Determination of wavelength of monochromatic light using Newton's rings and Michelson Interferometer.

UNIT-III Diffraction

Introduction, distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction – Diffraction due to single slit-Fraunhofer, Fraunhofer diffraction pattern with N slits (diffraction grating). Resolving power of grating, Determination of wavelength of light in normal incidence using diffraction grating. Fresnel's half period zones-area of the half period zones-zone plate-comparison of zone plate with convex lens-difference between interference and diffraction.

UNIT-IV Polarisation


Polarized light: methods of polarization by reflection, refraction, double refraction, Brewster's law- Maule's law-Nicol prism polarizer and analyser, Quarter wave plate, Half wave plate-optical activity, determination of specific rotation by Laurent's half shade Polarimeter. Idea of elliptical and circular polarization

UNIT-V Lasers and Holography

Lasers: introduction, spontaneous emission, stimulated emission. Population Inversion, Laser principle- Einstein Coefficients-Types of lasers-He-Ne laser, Ruby laser- Applications of lasers. Holography: Basic principle of holography-Gabor hologram and its limitations, Applications of holography.

REFERENCE BOOKS:

1. BSc Physics, Vol .2, Telugu Academy, Hyderabad

	Government College(Autonomous) Rajahmundry	Program & Semester II B.Sc. (III Sem)			
Course Code 324901	WAVE OPTICS PRACTICALS				
Teaching	Hours Allocated: 2hrs/week (Practicals)	L	T	P	C
Pre-requisites:	Spectrometer, Travelling microscope, Laser safety operation.	0	0	2	1

COURSE OBJECTIVE:


To develop practical skills in the use of laboratory equipment and experimental techniques for studying light and its interactions with matter.

LEARNING OUTCOMES:

1. Mastery of experimental techniques: Students should become proficient in using laboratory equipment and experimental techniques for studying light and its interactions with matter.
2. Application of theory to practice: Students should be able to apply theoretical concepts learned in lectures to real-world situations, and understand the limitations of theoretical models.
3. Accurate recording and analysis of data: Students should be able to accurately record and analyze experimental data, including understanding the significance of error analysis and statistical methods.
4. Critical thinking and problem solving: Students should be able to identify sources of error, troubleshoot experimental problems, and develop critical thinking skills in experimental design and analysis.
5. Understanding of physical principles: Students should develop an understanding of the physical principles governing optics, including reflection, refraction, diffraction, interference, and polarization.

Minimum of 6 experiments to be done and recorded

1. Determination of radius of curvature of a given convex lens-Newton's rings.
2. Resolving power of grating.
3. Study of optical rotation –polarimeter.
4. Dispersive power of a prism.
5. Determination of wavelength of light using diffraction grating-minimum deviation method.
6. Determination of wavelength of light using diffraction grating-normal incidence method.
7. Determination of wavelength of laser light using diffraction grating.
8. Resolving power of a telescope.
9. Refractive index of a liquid-hallow prism
10. Determination of thickness of a thin wire by wedge method

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc (III Sem)			
Course Code 324902	HEAT AND THERMODYNAMICS				
Teaching	Hours Allocated: 3 hrs/week (Theory)	L	T	P	C
Pre-requisites:	Drift, Diffusion, Laws of thermodynamics, Heat capacities, Gas laws, Heat transfer methods, Statistics (mean, mode, median, Standard deviation, errors)	3	0	-	3

Course Objectives:

1. Understand the basic aspects of kinetic theory of gases, Maxwell-Boltzmann distribution law, equi-partition of energies, mean free path of molecular collisions and the transport phenomenon in ideal gases
2. Gain knowledge on the basic concepts of thermodynamics, the first and the second law of thermodynamics, the basic principles of refrigeration, the concept of entropy, the thermodynamic potentials and their physical interpretations.
3. Understand the working of Carnot's ideal heat engine, Carnot cycle and its efficiency
4. Develop critical understanding of concept of Thermodynamic potentials, the formulation of Maxwell's equations and its applications.
5. Differentiate between principles and methods to produce low temperature and liquefy air and also understand the practical applications of substances at low temperatures.
6. Examine the nature of black body radiations and the basic theories.

Course Outcomes:

On Completion of the course, the students will be able to-

Cognitive Domain

CO1	Students would learn about Kinetic Theory of gases, Maxwell's law of distribution of molecular velocities and its experimental verification, Mean free path, Degrees of freedom, Transport phenomenon viscosity, Thermal conductivity and diffusion of gases	thermodynamic potentials. Students would learn about various methods for producing very low temperatures and theory of Joule Kelvin effect.
CO2 CO3	Students would learn about Various thermodynamic processes, entropy changes in various processes and heat engines.	Students would learn about Blackbody and its spectral energy distribution of black body radiation, Various theories of Black body radiation, usage of various radiation measuring instruments.
CO4 CO5	Students would learn about various thermodynamic potentials and joule kelvin cooling concepts using	

SYLLABUS:

UNIT-I: KINETIC THEORY OF GASES:

Kinetic Theory of gases- Introduction, Maxwell's law of distribution of molecular velocities, Mean free path, Principle of equipartition of energy, Transport phenomenon in ideal gases: viscosity and Thermal conductivity.

UNIT-II: THERMODYNAMICS:

Introduction- Reversible and irreversible processes, Carnot's engine and its efficiency, Carnot's theorem, Thermodynamic scale of temperature, Second law of thermodynamics Entropy: Physical significance, Change in entropy in reversible and irreversible processes; Temperature- Entropy (T-S) diagram and its uses; change of entropy when ice changes into steam.

UNIT-III: THERMODYNAMIC POTENTIALS AND MAXWELL'S EQUATIONS:

Thermodynamic Potentials-Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy and their significance, Derivation of Maxwell's thermodynamic relations from thermodynamic potentials, Applications to (i) Clausius-Clayperon's equation (ii) Joule-Kelvin coefficient for ideal and Van der Waals' gases.

UNIT-IV: LOW TEMPERATURE PHYSICS:


Methods for producing very low temperatures, Joule Kelvin effect, porous plug experiment, Joule expansion, Distinction between adiabatic and Joule Thomson expansion, Expression for Joule Thomson cooling, Production of low temperatures by adiabatic demagnetization (qualitative).

UNIT-V: QUANTUM THEORY OF RADIATION:

Spectral energy distribution of black body radiation, Wein's displacement law and Rayleigh- Jean's law (No derivations), Planck's law of black body radiation-Derivation, Deduction of Wein's law and Rayleigh- Jean's law from Planck's law, Solar constant and its determination using Angstrom pyro heliometer, Estimation of surface temperature of Sun.

REFERENCE BOOKS

1. BSc Physics, Vol.2, Telugu Akademy, Hyderabad
2. Thermodynamics, R.C.Srivastava, S.K.Saha & Abhay K.Jain, Eastern Economy Edition.
3. Unified Physics Vol.2, Optics & Thermodynamics, Jai Prakash Nath & Co. Ltd., Meerut
4. Fundamentals of Physics. Halliday/Resnick/Walker. C. Wiley India Edition 2007
5. Heat and Thermodynamics -N BrijLal, P Subrahmanyam, S.Chand& Co.,2012

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. (III Sem)			
Course Code 324902	Heat and Thermodynamics				
Teaching	Hours Allocated: 2 hrs/week (Practical)	L	T	P	C
Pre-requisites:	Voltmeter, Ammeter, Rheostat, steam generators, Thermometer types.	0	0	2	1

COURSE OBJECTIVE:

The objectives for practicals in Heat and Thermodynamics can vary depending on the specific course or program, but here are some general objectives that may apply, to develop practical skills in the use of laboratory equipment and experimental techniques for studying heat and thermodynamics.

LEARNING OUTCOMES:

1. Mastery of experimental techniques: Students should become proficient in using laboratory equipment and experimental techniques for studying heat and thermodynamics.
2. Application of theory to practice: Students should be able to apply theoretical concepts learned in lectures to real-world situations, and understand the limitations of theoretical models.
3. Accurate recording and analysis of data: Students should be able to accurately record and analyze experimental data, including understanding the significance of error analysis and statistical methods.
4. Critical thinking and problem solving: Students should be able to identify sources of error, troubleshoot experimental problems, and develop critical thinking skills in experimental design and analysis.
5. Understanding of physical principles: Students should develop an understanding of the physical principles governing heat and thermodynamics, including the laws of thermodynamics, heat transfer, and thermodynamic cycles.

Minimum of 6 experiments to be done and recorded

1. Specific heat of a liquid –Joule’s calorimeter –Barton’s radiation correction
2. Thermal conductivity of bad conductor-Lee’s method
3. Thermal conductivity of rubber.
4. Measurement of Stefan’s constant.
5. Specific heat of a liquid by applying Newton’s law of cooling correction.
6. Heating efficiency of electrical kettle with varying voltages.
7. Thermo emf- thermo couple - Potentiometer
8. Thermal behavior of an electric bulb (filament/torch light bulb)
9. Measurement of Stefan’s constant- emissive method
10. Study of variation of resistance with temperature - Thermistor.

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. (III Sem)			
Course Code 324903	ELECTRONIC DEVICES AND CIRCUITS				
Teaching	Hours Allocated: 3 hrs/week (THEORY)	L	T	P	C
Pre-requisites:	Voltmeter, Ammeter, Rheostat, steam generators, Thermometer types.	3	0	0	3



COURSE OBJECTIVE:

The course on Electronic Devices and Circuits aims to provide students with a fundamental understanding of electronic devices and their applications in various circuits.

LEARNING OUTCOMES:

On Completion of the course, the students will be able to-		Cognitive Domain
CO1	Understand the behavior of P-N junction diodes in forward and reverse bias conditions and analyze the impact of junction capacitance on diode characteristics.	Understanding & Remembrance
CO2	Analyze and compare the characteristics and operation of different BJT configurations (CB, CE, and CC) and demonstrate proficiency in biasing techniques.	Application
CO3	Comprehend the operation and characteristics of FETs, including JFETs and MOSFETs, and explain the working principles and characteristics of UJT.	Analyzation
CO4	Describe the operation and applications of various photoelectric devices such as LEDs, photo diodes, phototransistors, and LDRs.	Application
CO5	Understand the operation of rectifiers (half-wave, full-wave, and bridge), analyze the ripple factor and efficiency, and demonstrate knowledge of different filter types and three-terminal voltage regulators	Application

SYLLABUS:

UNIT I: PN JUNCTION DIODES

P-N junction Diode, Formation of depletion region, Forward and Reverse bias Ideal Diode, Diode equation – Reverse saturation current – Tunnel Diode- Construction, working, V-I characteristics and Applications, Zener diode – V I characteristics, Applications

UNIT –II: BIPOLAR JUNCTION TRANSISTOR AND ITS BIASING: (D.C)

Transistor construction, working of PNP and NPN Transistors, Active, Cutoff and Saturation conditions, Configurations of Transistor - CB, CE, and CC, Input and Output Characteristics of CB and CE configurations. Hybrid parameters of a Transistor and equivalent circuit, BJT Transistor Biasing – Need for stabilization, Thermal runaway, Stability factor, Biasing methods - Voltage-Divider Bias.

UNIT-III: FIELD EFFECT TRANSISTORS & POWER ELECTRONIC DEVICES –

Difference between JFET and BJT, Construction and working of JFET, Drain and Transfer Characteristics, MOSFET - Depletion-type, and Enhancement-Type MOSFETs. FET Biasing: Voltage Divider Biasing. UJT- Construction, working, V-I characteristics. SCR – Construction, Working and Characteristics

UNIT IV: PHOTO ELECTRIC DEVICES:Light-Emitting Diodes (LEDs) - Construction, working, characteristics and Applications, IR Emitters, Photo diode - Construction, working characteristics and Applications, Phototransistors - Construction, working and characteristics, Applications, Structure and operation of LDR, Applications

UNIT-V: POWER SUPPLIES:

Rectifiers: Half wave, Full wave and bridge rectifiers - Efficiency (with derivations), ripple factor- Zener diode as Voltage Regulator, Filters- choke input (inductor), L-section, π -section filters. Three terminal fixed voltage IC-regulators (78XX and 79XX)

REFERENCE BOOKS:

1. Electronic Devices and Circuit Theory --- Robert L. Boylestad & Louis Nashelsky.
2. Electronic Devices and Circuits I – T.L.Floyd- PHI Fifth Edition
3. Integrated Electronics – Millmam & Halkias.
4. Electronic Devices & Circuits – Bogart.
5. Sedha R.S., A Text Book Of Applied Electronics, S.Chand & Company Ltd

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	3	1	3	1	2	2	3	2	3	2	2	3	2
CO2	3	2	3	3	2	3	3	1	3	3	3	2	3	3	2	3
CO3	2	3	2	1	2	3	2	2	2	3	2	2	3	3	2	3
CO4	3	3	3	2	2	2	3	3	1	1	3	1	2	1	3	2
CO5	3	2	3	2	2	2	2	3	1	1	3	1	2	2	3	1



**Government College (Autonomous)
Rajahmundry**

**Program &
Semester**
II B.Sc. (III Sem)

Course Code
324903

ELECTRONIC DEVICES AND CIRCUITS

Teaching

Hours Allocated: 2 hrs/week (PRACTICAL)

L

T

P

C

Pre-requisites:

Voltmeter, Ammeter, Rheostat, Bread board, CRO,
Thermometer types.

0

0

2

1

COURSE OBJECTIVE:

The course objectives for a practical course in Electronic Devices and Circuits might provide hands-on experience with the fundamental principles of electronic devices and circuits.

LEARNING OUTCOMES:

1. Understand the principles of electronic devices and circuits and their applications in real-world scenarios.
2. Analyze and design electronic circuits using diodes, transistors, and operational amplifiers.
3. Understand the importance of biasing and stability in electronic circuits and how to achieve them.
4. Develop the skills to design and analyze amplifier circuits and to understand the concept of feedback and its application in electronic circuits.
5. Analyze and design simple oscillators, power supplies, and filters.
6. Gain hands-on experience with electronic test equipment such as multimeters, oscilloscopes, and function generators.
7. Develop skills in circuit construction, measurement, and testing.
8. Learn how to troubleshoot and diagnose electronic circuit problems.
9. Understand the safety procedures for working with electronic circuits and equipment.

Minimum of 6 experiments to be done and recorded

1. V-I Characteristics of junction diode
2. V-I Characteristics of Zener diode
3. Transistor characteristics – CB configuration
4. Transistor characteristics – CE configuration
5. FET input and output characteristics
6. UJT characteristics
7. LDR characteristics
8. Full wave and Bridge rectifier with filters



**Government College (Autonomous)
Rajahmundry**

Course Code
324904

ANALOG AND DIGITAL ELECTRONICS

**Program &
Semester**
II B.Sc. (III Sem)

Teaching

Hours Allocated: 3 hrs/week (THEORY)

L

T

P

C

Pre-requisites:

Kirchhoff's Laws, Ohm's Law, number system

3

0

0

3

COURSE OBJECTIVE:

The course on Analog and Digital Electronics aims to provide students with a fundamental understanding of the principles of electronic circuits and their applications in both analog and digital systems.

LEARNING OUTCOMES:

On Completion of the course, the students will be able to-		Cognitive Domain
CO1	Understand Principles and Working of Operational Amplifier	Understanding & Remembrance
CO2	To understand the Boolean algebra and simplification of Boolean expressions.	Application
CO3	knowledge on OP-Amp in different Applications	Analyzation
CO4	To understand the number systems, Binary codes and Complements.	Application
CO5	To analyze logic processes and implement logical operations using combinational logic circuits.	Application

UNIT-I: OPERATIONAL AMPLIFIERS

- a) Concept of feedback in CE amplifier, negative and positive feedback, advantages and disadvantages of negative feedback, Basic concepts of differential amplifier, Block diagram of op amp and its equivalent circuit, IC Diagram (IC 741), Ideal voltage transfer curve, Open loop Op-Amp configurations- differential, inverting and non-inverting Op-Amps.
- b) Voltage Series Feedback Amplifier (Non-Inverting Op amp): Gain and Bandwidth derivations: Voltage Shunt Feedback Amplifier (Inverting Op amp): Gain and Bandwidth derivations

UNIT-II: PRACTICAL OPERATIONAL AMPLIFIER AND APPLICATIONS

- a) Characteristics of an Ideal and Practical Operational Amplifier (IC 741), Input offset voltage, Input bias current, Input offset current, total output offset voltage, CMRR, slew rate and concept of virtual ground.
- b) Applications of Op-Amp: Linear Applications: Voltage Follower, Summing Amplifier, Subtracting Amplifier, Averaging Amplifier, Difference Amplifier, Integrator and Differentiator, Square Wave response of Integrator and Differentiator (Brief explanation only)

UNIT-III: NUMBER SYSTEMS, CODES AND LOGIC GATES

- a) Number Systems and Codes: Decimal, Binary, Octal and Hexadecimal number systems, conversions, Binary addition, Binary subtraction using 1's and 2's complement methods, BCD code and Gray code –
Conversions
- b) Logic Gates: Construction and truth tables of OR, AND, NOT gates, Universal gates – Basic construction and truth tables of NOR & NAND, Realization of logic gates using NAND and NOR, XOR and XNOR Logic gates symbol and their truth tables. De Morgan's Laws, Boolean Laws, Simplification of Boolean Expressions using Boolean Laws

UNIT-IV: ARITHMETIC CIRCUITS & DATA PROCESSING CIRCUITS

- a) Half Adder and Full Adder: Explanation of truth tables and Circuits. Half Subtractor and Full Subtractor: Explanation of truth tables and Circuits, 4 - bit binary Adder/Subtractor.
- b) Multiplexers - 2 to 1 Multiplexer, 4 to 1 multiplexer, De-multiplexers: 1 to 2 Demultiplexer, 1 to 4 Demultiplexer, Applications of Multiplexers and Demultiplexers Decoders: 1 of 2 decoders, 2 of 4 decoders, Encoders: 4 to 2 Encoder, 8 to 3 Encoder, Applications of decoders and encoders

UNIT-V: SEQUENTIAL LOGIC CIRCUITS & CODE CONVERTERS

- a) Combinational Logic vs Sequential Logic Circuits, Sequential Logic circuits: Flip-flops, Basic NAND, NOR Latches, Clocked SR Flip-flop, JK Flip-flop, D Flip-flop, Master-Slave Flip-flop, Conversion of Flip flops.

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. (III Sem)			
Course Code 324904	ANALOG AND DIGITAL ELECTRONICS				
Teaching	Hours Allocated: 2 hrs/week (Practical)	L	T	P	C
Pre-requisites:	Kirchhoff's Laws, Ohm's Law, number system	0	0	2	1



COURSE OBJECTIVES:


The course objectives for a practical course in Analog and Digital Electronics might provide students with hands-on experience in designing, constructing, and testing analog and digital electronic circuits.

LEARNING OUCOMES:

1. Understand the principles of analog and digital electronic circuits and their applications in real-world scenarios.
2. Analyze and design analog electronic circuits using diodes, transistors, and operational amplifiers.
3. Analyze and design digital electronic circuits using logic gates, flip-flops, and counters.
4. Understand the importance of biasing, feedback, and stability in electronic circuits and how to achieve them.
5. Develop the skills to design and analyze amplifier circuits and digital systems.

Minimum six experiments to be done and recorded.

1. To study the operational amplifier as inverting feedback amplifier with verifying gain
2. To study the operational amplifier as non-inverting feedback amplifier with verifying gain
3. To study operational amplifier as adder
4. To study operational amplifier as subtractor
5. To study operational amplifier as differentiator
6. To study operational amplifier as integrator
7. Logic Gates- OR, AND, NOT and NAND gates. Verification of Truth Tables.
8. Verification of De Morgan's Theorems.
9. Construction of Half adder and Full adders-Verification of truth tables
10. Flip flops
11. Multiplexer and De-multiplexer
12. Encoder and Decoder

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. (IV Sem)			
Course Code 424901	ELECTRICITY AND MAGNETISM				
Teaching	Hours Allocated: 3 hrs/week (Theory)	L	T	P	C
Pre-requisites:	Differentiation, line, surface and volume integration, Coulomb's law, AC, DC, VC, RMS Value and Classification of materials based on electrical conductivity, Introduction to semiconductors.	3	0	-	3

COURSE OBJECTIVE:

The course on Electricity and Magnetism aims to provide students with a fundamental understanding of the principles of electricity, magnetism, and their interactions

LEARNING OUTCOMES:

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

On Completion of the course, the students will be able to-		Cognitive domain
CO1	Students would be able to learn about the concepts of electric field and electric potential due to point charge, solid sphere, and cylinder. These concepts will enhance the student towards the problems come across in the real life. Students would also be able to learn about the concept of dielectrics and its applications	Understanding & Remembrance
CO2	Students would be able to learn about the concepts of Biot-Savart's law, Faraday's law and its applications. Students would also be able to learn about Faraday's laws and their applications in daily life like solenoid	Application
CO3	Students would be able to learn about different combinations of Inductor, capacitance and resistor and also their performance characteristics. Students would also be able to learn about mathematical description of Electromagnetic Waves i.e. Maxwell's equations	Analysis
CO4	Students would be able to learn about Semiconductor devices i.e. PN junction diode, Zener diode and transistors and their characteristics so that the student can be able to use appropriately	Understanding
CO5	1. Develop an understanding on the unification of electric, and magnetic fields and Maxwell's equations governing electromagnetic waves.	Application

UNIT-I Electrostatics and Dielectrics

Gauss's law-Statement and its proof, Electric field intensity due to (i) uniformly charged solid sphere, Electrical potential–Equipotential surfaces, Potential due to a uniformly charged sphere. Dielectrics-Polar and Non-polar dielectrics- Effect of electric field on dielectrics, Dielectric strength, Electric displacement D, electric polarization Relation between D, E and P, Dielectric constant and electric susceptibility.

UNIT-II Current electricity

Electrical conduction-drift velocity-current density, equation of continuity, ohms law and limitations, Kirchhoff's Law's, Wheatstone bridge-balancing condition - sensitivity. Branch current method, Nodal Analysis, star to delta & delta to star conversions. Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum power transfer theorem.

UNIT-III Magneto statics

Biot-Savart's law and its applications: (i) circular loop and (ii) solenoid, Ampere's Circuital Law and its application to Solenoid, Hall effect, determination of Hall coefficient and applications.

Electromagnetic Induction:

Faraday's laws of electromagnetic induction, Lenz's law, Self-induction and Mutual induction, Self-inductance of a long solenoid, Magnetic Energy density. Mutual inductance of a pair of coils. Coefficient of Coupling

UNIT-IV Electromagnetic waves-Maxwell's equations:

Basic laws of electricity and magnetism- Maxwell's equations- integral and differential forms Derivation, concept of displacement current. Plane electromagnetic wave equation, Hertz experiment-Transverse nature of electromagnetic waves. Electromagnetic wave equation in conducting media. Pointing vector and propagation of electromagnetic waves

UNIT-V Varying and alternating currents:

Growth and decay of currents in LR, CR, LCR circuits-Critical damping. Alternating current - A.C. fundamentals, and A.C through pure R, L and C. Relation between current and voltage in LR and CR circuits, Phasor and Vector diagrams, LCR series and parallel resonant circuit, Q –factor, Power in ac circuits, Power factor.

REFERENCE BOOKS

1. BSc Physics, Vol.3, Telugu Akademy, Hyderabad.
2. Electricity and Magnetism, D.N. Vasudeva. S. Chand & Co.
3. Electricity, Magnetism with Electronics, K.K.Tewari, R.Chand & Co.,
4. "Electricity and Magnetism" by Brijlal and Subramanyam Ratan Prakashan Mandir, 1966
5. "Electricity and Magnetism: Fundamentals, Theory, and Applications" by R. Murugesan, Kiruthiga Siva prasath, and M. Saravanapandian
6. "Electricity and Magnetism: Theory and Applications" by Ajoy Ghatak and S. Lokanathan
7. Electricity and Magnetism: Problems and Solutions" by Ashok Kumar and Rajesh Kumar
8. Electricity and Magnetism, R.Murugesan, S. Chand & Co.


WebLinks:

1. <https://ocw.mit.edu/courses/physics/8-02-physics-ii-electricity-and-magnetism-spring-2007>
2. <http://physics.bu.edu/~duffy/classroom.html>
3. <https://nptel.ac.in/courses/115/106/115106122/>

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	3	3	1	2	2	3	2	3	2	3	2	2
CO2	3	2	3	3	2	3	3	1	3	3	3	2	1	2	1	3
CO3	2	3	2	3	2	3	2	2	2	3	2	2	3	3	1	2
CO4	3	2	3	2	2	2	3	3	1	1	3	1	2	2	2	1
CO5	3	2	3	2	2	2	3	3	1	1	3	1	2	1	3	2

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. (IV Sem)			
Course Code 424901	ELECTRICITY AND MAGNETISM				
Teaching	Hours Allocated: 3 hrs/week (PRACTICAL)	L	T	P	C
Pre-requisites:	Differentiation, line, surface and volume integration, Coulomb's law, AC, DC, VC, RMS Value	0	0	2	1

COURSE OBJECTIVE:

The course objective for a practical course in electricity and magnetism may include to develop practical skills in handling electrical and electronic components, such as resistors, capacitors, inductors, transformers, and oscillators.

LEARNING OUTCOMES:

Demonstrate a thorough understanding of the fundamental concepts and principles of electricity and magnetism.

Apply the laws and principles of electricity and magnetism to analyze and solve electrical and magnetic problems.


Design, construct, and test electrical circuits using various components and measuring instruments.

Measure and analyze electrical quantities such as voltage, current, resistance, capacitance, and inductance using appropriate instruments.

Apply the principles of electromagnetism to understand and analyze the behavior of magnetic fields and their interactions with electric currents

Minimum of 6 experiments to be done and recorded

1. Figure of merit of a moving coil galvanometer.
2. LCR circuit series/parallel resonance, Q factor.
3. Determination of ac-frequency –Sonometer.
4. Verification of Kirchhoff's laws and Maximum Power Transfer theorem.
5. Verification of Thevenin's and Norton's theorem
6. Field along the axis of a circular coil carrying current-Stewart & Gee's apparatus.
7. Charging and discharging of CR circuit-Determination of time constant
8. A.C Impedance and Power factor
9. Determination of specific resistance of wire by using Carey Foster's bridge.


	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. (IV Sem)			
Course Code 424902	MODERN PHYSICS				
Teaching	Hours Allocated: 3 hrs/week (Theory)	L	T	P	C
Pre-requisites:	Atomic models, Types of spectra, Matrices, Types of forces in nature, Electrical conductivity.	3	0	-	3

COURSE OBJECTIVE:

The course on Modern Physics aims to provide students with an understanding of the principles of modern physics and their applications in various fields.

LEARNING OUTCOMES:

On Completion of the course, the students will be able to-		
CO1	Students would able to learn about the concepts of atomic models and their drawbacks. Students would also learn about Stern & Gerlach experiment Vector atom model, this model gives the existence of spin of an electron. Study of fine spectra and Zeeman effect on various elements.	KNOWLEDGE
CO2	Students would able to learn about the importance of Quantum mechanics, study the basic concepts involved in the origin of quantum mechanics like uncertainty principle, De-Broglie matter waves, and experiments that confirm wave nature of matter and particle nature of radiation.	KNOWLEDGE
CO3	Students would able to learn about the importance of Heisenberg's uncertainty principle for position and momentum. Students would able to learn Schrodinger time independent and time dependent wave equations. Wave function properties Significance. Basic postulates of quantum mechanics. from these we can predict the position of a particle at future specific time	UNDERSTANDING
CO4	Students would learn about basic properties of nucleus, dipole & quadropole moments, binding energy, nuclear forces and nuclear models. Elementary particles and counters	APPLICATION
CO5	Students would learn about basics of nanomaterials, classification, properties. Students would also learn about Introduction to Superconductivity, types and applications.	APPLICATION

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. (IV Sem)			
Course Code 424902	MODERN PHYSICS				
Teaching	Hours Allocated: 3 hrs/week (PRACTICAL)	L	T	P	C
Pre-requisites:	Atomic models, Types of spectra, Matrices, Types of forces in nature, Electrical conductivity.	0	0	2	1

COURSE OBJECTIVE:


The course objective for a practical course in Modern Physics may provide hands-on experience with experimental techniques and equipment used in modern physics experiments.

LEARNING OUTCOMES:

1. Apply experimental techniques and equipment to investigate and analyze phenomena related to modern physics, such as quantum mechanics, relativity, atomic physics, and nuclear physics.
2. Demonstrate a deep understanding of the principles and theories of modern physics through hands-on experimentation and data analysis.
3. Develop proficiency in using advanced laboratory instruments and techniques specific to modern physics experiments, such as spectroscopy, interferometry, particle detectors, and radiation measurement.
4. Analyze and interpret experimental data using statistical methods and error analysis, drawing meaningful conclusions and relating them to theoretical concepts.
5. Design and conduct independent experiments or investigations related to modern physics, demonstrating the ability to plan, execute, and analyze experimental procedures and results.

Minimum of 6 experiments to be done and recorded

1. e/m of an electron by Thomson method.
2. Determination of Planck's Constant (photocell).
3. Verification of inverse square law of light using photovoltaic cell.
4. Determination of the Planck's constant using LEDs of at least 4 different colours.
5. Determination of work function of material of filament of directly heated vacuum diode.
6. Determination of M & H.
7. Energy gap of a semiconductor using junction diode.
8. Energy gap of a semiconductor using thermistor.

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. (IV Sem)			
Course Code 424903	INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS				
Teaching	Hours Allocated: 3 hrs/week (Theory)	L	T	P	C
Pre-requisites:	Atomic models, Types of spectra, Matrices, Types of forces in nature, Electrical conductivity.	3	0	-	3

COURSE OBJECTIVE:

The course aims to provide students with an understanding of the principles of Nuclear and Particle physics and their applications in various fields.

LEARNING OUTCOMES:

On Completion of the course, the students will be able to-		COGNATIVE DOMAIN
CO1	know about high energy particles and their applications which prepares them for further study and research in elcitrapphysics	SKILL
CO2	Students can explain important concepts on nucleon-nucleon interaction, such as its short-range, spin dependence, isospin, and tensors.	UNDERSTANDING
CO3	Students can show the potential shapes from nucleon nucleon interactions.	APPLICTIONS
CO4	can explain the single particle model, its strengths, and weaknesses	PPLITIONS
CO5	Students can explain magic numbers based on this model	UNDERSTANDING

SYLLABUS: INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS

UNIT-I: Introduction to Nuclear Physics

Nuclear Structure: General Properties of Nuclei, Mass defect, Binding energy; Nuclear forces: Characteristics of nuclear forces- Yukawa's meson theory; Nuclear Models- Liquid drop model- Semi empirical mass formula, nuclear shell model.

UNIT-II: Elementary Particles And Interactions

Discovery and classification of elementary particles, properties of leptons, mesons and baryons; Types of interactions- strong, electromagnetic and weak interactions; Conservation laws – Isospin, parity, charge conjugation

UNIT-III: Nuclear Reactions and Nuclear Detectors

Nuclear Reactions: Types of reactions, Conservation Laws in nuclear reactions, Reaction energetic, Threshold energy, nuclear cross-section; Nuclear detectors: Geiger- Muller counter, Scintillation counter, Cloud chamber

UNIT-IV: Nuclear Decays and Nuclear Accelerators

Nuclear Decays: Gamow's theory of alpha decay, Fermi's theory of Beta- decay, Energy release in Beta-decay, selection rules. Nuclear Accelerators: Types- Electrostatic and electrodynamic accelerators; Cyclotron-construction, working and applications; Synchrocyclotron-construction, working and applications.

UNIT-V: Applications of Nuclear and Particle Physics

Medical Applications: Radiation therapy and imaging techniques, nuclear energy: nuclear reactors and power generation, Particle physics in high-energy Astro Physics


Reference Books:

1. Nuclear Physics, Irving Kaplan, Narosa Pub. (1998).
2. Nuclear Physics, Theory and experiment – P.R. Roy and B.P. Nigam, New Age Int.1997.
3. Atomic and Nuclear Physics (Vol.2), S.N. Ghoshal, S. Chand & Co. (1994).
4. Nuclear Physics, D.C. Tayal, Himalaya Pub. (1997).
5. Atomic and Nuclear Physics, R.C. Sharma, K. Nath & Co., Meerut.
6. Nuclei and Particles, E. Segre.
7. Introduction to Nuclear Physics, H.A. Enge, Addison Wesley (1975).

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	2	3	3	3	2	2	2	3	2	3	2	3	2	2
CO2	3	2	2	3	2	3	3	1	3	3	2	2	1	2	2	3
CO3	2	2	2	3	2	2	3	2	3	3	2	2	2	3	1	2
CO4	3	2	3	2	2	2	3	3	1	2	3	3S	2	2	2	2
CO5	2	3	3	2	2	2	3	3	1	2	3	1	2	1	3	2

	Government College (Autonomous) Rajahmundry	Program & Semester III B.Sc. (V Sem)			
Course Code 524901	APPLICATIONS OF ELECTRICITY AND MAGNETISM				
Teaching	Hours Allocated: 3 hrs/week (Theory)	L	T	P	C
Pre-requisites:	a) Resistors , Types of Resistors , Types of Inductors, Power sources , FM Transmitter, FM Receiver	3	0	2	3

COURSE OBJECTIVE:

The objective of the course on Applications of Electricity and Magnetism is to provide students with a comprehensive understanding of the practical applications of electricity and magnetism in various fields. The course aims to develop students' knowledge and skills in applying electrical and magnetic principles to real-world problems and technologies.

LEARNING OUTCOMES:

On Completion of the course, the students will be able to-		COGNATIVE DOMAIN
CO1	Identify various components present in Electricity & Electronics Laboratory.	SKILL
CO2	knowledge of each component and its utility (like resistors, capacitors, inductors, power sources etc.).	KNOWLEDGE
CO3	Demonstrate skills of constructing simple electronic circuits consisting of basic circuit elements.	SKILL
CO4	Students Understand the need & Functionality of various DC & AC Power sources.	UNDERSTANDING
CO5	Comprehend the design, applications and practices of various electrical & Electronic devices and also their trouble shooting.	APPLICATION

Unit-I: Introduction to Passive Elements

a) Passive elements

Resistor - Types of Resistors, Color coding, Combination of Resistors – Series combination (Voltage division), Parallel combination (Current division), Ohms Law and its limitation. Inductor - Principle, EMF induced in an Inductor, Energy stored in Inductor, Phase relation between V and I, Combinations of Inductors, Types of Inductors. Capacitor - Principle, Charging and discharging of a Capacitor, Types of Capacitors, Color coding

b) Applications of Passive elements:

Applications of a Resistor as a heating element in heaters and as a fuse element. Open circuit, Short circuit, Applications of Inductors, Application of choke in a fan and in a radio tuning circuit, Series resonance circuit as a Radio tuning circuit. Applications of Capacitor in power supplies, motors (Fans) etc.

Unit-II Power Sources (Batteries)

a) Power sources:

Types of power sources-DC & AC sources, Different types of batteries, Rechargeable batteries –Lead acid batteries, Li-ion batteries **Series, Parallel & Series-Parallel configuration of batteries,**

b) Network Theorems for DC circuits

Thevenin's theorem, Norton's theorem, Maximum Power transfer theorem, Constant Voltage source- Constant Current Source-Applications of Current sources & Voltage sources, SMPS used in computers.

Unit-III Alternating & Direct Currents

(A.C Generator, Construction and its working principle, Types of AC Generators, DC Generator, Construction and its working principle, advantages and disadvantages, Applications, Types of DC Generators, Losses associated with DC generators, Differences between DC and AC generators

a) Transformers- Construction and its working principle, EMF equation, Open circuit and short circuit tests, Types of Transformers - Step-down and Step-up Transformers, Relation between primary turns and secondary turns of the transformer with emf, Use of a Transformer in a regulated Power supplies, Single phase motor – working principle, Applications of motors (like water pump, fan etc).

Unit-IV Modulation Circuits

b) Need for modulation, Types of modulation, Amplitude modulation, modulation index, Waveforms, Power relations, Demodulation, Diode detector, AM transmitter, AM Receiver, Frequency modulation, modulation index, Waveforms, FM Transmitter, FM Receiver

c) Transmitters and Receivers:

AM transmitter, AM Receiver, Frequency modulation, modulation index, Waveforms, FM Transmitter, FM Receiver

Unit-V Applications of EM Induction & Power Supplies

- a) DC motor – Construction and operating principle, Calculation of power, voltage and current in a DC motor, Design of a simple Motor (for example Fan) with suitable turns of coil
- b) Working of a DC regulated power supply, Construction of a 5 volts regulated power supply, Design of a step-down (ex:220-12V) and step-up (ex:120-240V) transformers-Simple Design of FM Radio circuit using LCR series resonance (tuning) circuit, Checking the output voltage of a battery eliminator using a Multimeter. (Trouble shooting), Design of a simple 5 volts DC charger, Power supply for computers (SMPS)


References:

1. Grob's Basic Electronics by Mitchel Schultz , TMH or McGraw Hill
2. Electronic and Electrical Servicing by Ian Robertson Sinclair, John Dunton, Elsevier Publications
3. Troubleshooting Electronic Equipment by R.S.Khandapur ,TMH
4. Web sources suggested by the teacher concerned and the college librarian including reading material.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	3	3	2	2	2	3	2	3	2	3	2	2
CO2	3	2	2	3	2	3	3	1	3	2	2	2	1	2	2	1
CO3	2	2	2	3	3	2	3	2	3	2	2	2	2	3	2	2
CO4	2	2	3	1	2	2	2	3	1	2	3	3S	2	2	2	2
CO5	2	3	3	2	2	2	3	3	1	2	3	1	2	1	3	2

	Government College (Autonomous) Rajahmundry	Program & Semester III B.Sc. (V Sem)			
Course Code 524902	ELECTRONIC INSTRUMENTATION				
Teaching	Hours Allocated: 3 hrs/week (Theory)	L	T	P	C
Pre-requisites:	a) Resistors , Types of Resistors , Types of Inductors, Power sources , FM Transmitter, FM Receiver	3	0	2	3

COURSE OBJECTIVE:

The objective of the course on Electronic Instrumentation is to provide students with a comprehensive understanding of various electronic instruments used for measurement, data acquisition, and control applications. The course aims to develop students' knowledge and skills in the design, operation, calibration, and application of electronic instruments.

LEARNING OUTCOMES:

Students after successful completion of the course will be able to:		
On Completion of the course, the students will be able to-		COGNATIVE DOMINE
CO1	Identify various facilities required to set up a basic Instrumentation Laboratory.	SKILL
CO2	Acquire a critical knowledge of various Electrical Instruments used in the Laboratory	KNOWLEDGE
CO3 CO4 CO5	Demonstrate skills of using instruments like CRO, Function Generator, Multimeter etc. through hands on experience. Understand the Principle and operation of different display devices used in the display systems and different transducers Comprehend the applications of various biomedical instruments in daily life like B.P. meter, ECG, Pulse oximeter etc. and know the handling procedures with safety and security.	SKILL UNDERSTANDING APPLICATION

SYLLABUS:

UNIT-I Introduction to Instruments

(a) Basic of measurements:

Instruments accuracy, precision, sensitivity, resolution, range, errors in measurement, Classification of Instruments, Analog instruments & Digital Instruments, Construction and working of an Analog Multimeter and Digital Multimeter (Block diagram approach), DC Voltmeter and AC Voltmeter, Sensitivity, 3½ display and 4½ display Digital Multimeter, Sources of errors in the Measurement of resistance, voltage and current, Specifications of Multimeter and their significance.

b) Balancing and damping Moving iron instruments & PMMC instruments.

UNIT-II Oscilloscope

a) Cathode ray oscilloscope – Principle and block diagram of CRO - Cathode Ray Tube – functioning – various controls

b) Applications CRO: Measurement of voltage (dc and ac), frequency & time period, Different types of oscilloscopes and their uses, Digital storage Oscilloscope

UNIT-III Transducers and Bridges

a) Linear Variable Differential Transformer (LVDT), Resistive, Capacitive & Inductive transducers, Piezo-electric transducer.

b) DC Bridge -Wheatstone's bridge, AC Bridges - Measurement of Inductance and Capacitance – Maxwell's bridge, Schering Bridge, Measurement of frequency – Wien's bridge.

UNIT-IV ADC and DAC & Display Instruments

a) A/D & D/A converters - Binary ladder, A/D converters –successive approximation type.

b) Introduction to Display devices, LED Displays, Seven Segment Displays, Construction and operation (Display of numbers), Types of SSDs (Common Anode & Common Cathode type), Limitations of SSDs, Liquid Crystal Displays, Principle and working, Applications of LCD modules.


UNIT-V Amplifiers, Oscillators & Biomedical Instruments

a) Amplifiers – Classification of amplifiers, Coupling amplifiers – RC Coupled amplifier – frequency response characteristics (no derivation), Feedback in Electronic circuits – Positive and Negative feedback, expressions for gains, advantages of negative feedback, Barkhausen criteria, RC phase shift oscillator.

b) Basic operating principles and uses of (i) ECG machine (ii) Radiography (iii) Ultrasound scanning (iv) Ventilator (v) Pulse oximeter.

REFERENCE BOOKS:

1. Electronic Instrumentation by H.S.Kalsi ,TMH Publishers
2. Electronic Instrument Hand Book by Clyde F. Coombs ,McGraw Hill
3. Introduction to Biomedical Instrumentation byMandeep Singh, PHI Learning.

	Government College (Autonomous) Rajahmundry	Program & Semester III B.Sc. (V Sem)			
Course Code 524903	OPTICAL INSTRUMENTS AND OPTOMETRY				
Teaching	Hours Allocated: 3 hrs/week (Theory)	L	T	P	C
Pre-requisites:	a) Simple Microscope, Refracting Telescopes and Reflecting telescopes , Astronomical Telescope and Terrestrial Telescopes, applications of various microscopes	3	0	2	1

COURSE OBJECTIVE:

The objective of the course on Optical Instruments and Optometry is to provide students with a comprehensive understanding of the principles, design, and application of optical instruments used in various fields, with a specific focus on optometry

LEARNING OUTCOMES:

Students at the successful completion of the course will be able to:

		COGNATIVE DOMAIN	
On Completion of the course, the students will be able to-		UNDERSTAND	ING KNOWLEDGE
CO1	Understand the construction and working principles of various optical instruments used in daily life.		
CO2	Acquire a critical knowledge on the various defects of eye and their correcting method with suitable lenses.		
CO3		Demonstrate skills of using biological microscope through hands on experience. UNDERSTAND ING	
CO4 CO5	Understand the various techniques used in optometry and computer based eye testing. Comprehend the various applications of microscopes and telescopes.	UNDERSTAND ING APPLICATION	

SYLLABUS:

UNIT-I Optical Microscopes

Simple Microscope-Construction, Magnifying power, normal adjustment; Compound Microscope-Construction, Magnifying power, normal adjustment, Phase contrast microscope-Operating principle, travelling microscope-Construction, working and uses

UNIT-II Telescopes

Refracting Telescopes and Reflecting telescopes, Construction, working and magnifying power of Astronomical Telescope and Terrestrial Telescopes, Binoculars – working principle and applications.

UNIT-III Applications Of Optical Instruments

Introductory ideas and applications of various microscopes viz., (i) Optical microscopes (Compound microscope, Stereo microscope, Confocal microscope) (ii) Electron microscopes (TEM, SEM), (iii) Scanning Probe microscope (iv) Scanning Acoustic microscope and (v) X-ray microscope. Introductory ideas and applications of various telescopes viz., (i) Optical telescopes (ii) Radio telescopes (iii) Solar telescopes (iv) Infrared telescope (v) Ultraviolet telescope

UNIT-IV Optical Vision

Introduction to optical Vision, Eye as an optical instrument, Formation of image in the eye and the camera, Ophthalmic lenses, Myopia and Hyper metropia defects, Removal of defects in vision using ophthalmic lenses, Contact lenses-Working principle, Different types of Contact lenses.


UNIT-V Ophthalmic Techniques and Optometry

Ophthalmoscope and keratometer and their working principles, Evaluation of eye disorders, Guidelines for standardized eye chart preparation, Simple phoropter and its working principle and its uses, Principles of Computer based eye testing

Reference Books

1. Optics and Optical Instruments: An Introduction by B. K. Johnson, Dover Publications.
2. Modern Optical Instruments and their construction by or ford Henry-Publisher: Biblio Life, LLC.
3. A Text Book of Optics by Brj Lal and N.Subramanyam, S.Chand & Co.
4. Practical Optics by Menn Naftly, Elsevier Science Publishing.
5. Applications of Optics in daily life | CK-12 Foundation. <https://flexbooks.ck12.org> ›
6. Web sources suggested by the teacher concerned and the college librarian including Reading material.

CO-PO Mapping:

	Government College (Autonomous) Rajahmundry	Program & Semester III B.Sc. (V Sem)			
Course Code 524903	OPTICAL INSTRUMENTS AND OPTOMETRY				
Teaching	Hours Allocated: 2 hrs/week (Practical)	L	T	P	C
Pre-requisites:	a) Simple Microscope, Refracting Telescopes and Reflecting telescopes , Astronomical Telescope and Terrestrial Telescopes, applications of various microscopes	0	0	2	1

COURSE OBJECTIVE:

The objective of the practical course on Optical Instruments and Optometry is to provide students with hands-on experience and practical skills in the operation, calibration, and application of optical instruments used in optometry

Learning Outcomes:

On successful completion of this practical course, student shall be able to:


- ❖ List out, identify and handle various equipment like binoculars, telescopes and microscopes.
- ❖ Learn the procedures of operation of various optical instruments.
- ❖ Demonstrate skills on testing the power of lenses, improving the resolution of telescopes and microscopes.
- ❖ Acquire skills in observing and measuring the power, focal length and different refractive errors of eye.
- ❖ Perform some techniques related to testing the blood and other biological samples.
- ❖ Understand the technique of operation of Computer eye testing and evaluation.

Practical (Laboratory) Syllabus:

1. Evaluation of magnifying power of simple microscope.
2. Measurement of reflection and transmission coefficient of certain materials using a microscope.
3. Resolving power of telescope
4. Determination of radii of different capillary tubes using travelling microscope.
5. Refractive index of a liquid (water) using (i) concave mirror and (ii) convex lens and a plane mirror.
6. Removal of refractive errors of eye using combination of lenses.
7. Determination of power of a convex lens by finding its focal length.

Lab References:

1. A Practical Guide to Experimental Geometrical Optics by Yuriy A. Garbovskiy- Cambridge Univ. Press
<https://physics.columbia.edu/sites/default/files/content/Lab%20Resources/1292%20Lab%20Manual.pdf>
2. https://www.lnmiit.ac.in/Department/Physics/uploaded_files/lab-manual.pdf
3. Basic Optics Experiments -<http://www.phys.unm.edu> > Optics Lab > Basics
4. A Practical Guide to Experimental Geometrical Optics by Yuriy A. Garbovskiy, Anatoliy V. Glushchenko, Cambridge Univ. Press
5. Web sources suggested by the teacher concerned.
http://www.phy.olemiss.edu/~thomas/weblab/Optics_lab_Items/Telescope_Microscope_PROCED_Spring_2018.pdf

	Government College (Autonomous) Rajahmundry	Program & Semester III B.Sc. (V Sem)			
Course Code 524904	OPTICAL IMAGING AND PHOTOGRAPHY				
Teaching	Hours Allocated: 3 hrs/week (Theory)	L	T	P	C
Pre-requisites:	a) Working principle of a camera , Different types of Digital cameras and their parts, Significance and role of Camera lens in photo shooting ,	3	0	2	1

COURSE OBJECTIVE:

The objective of the course on Optical Imaging and Photography is to provide students with a comprehensive understanding of the principles, techniques, and applications of optical imaging and photography. The course aims to develop students' theoretical knowledge and practical skills in capturing, processing, and interpreting images using optical devices and imaging technologies.

LEARNING OUTCOMES:

Students after successful completion of the course will be able to:

On Completion of the course, the students will be able to-		COGNATIVE DOMAIN
CO1	Identify the different types of cameras and camera lenses according to different purposes.	SKILL
CO2	Identify and understand the focal length of the different types of lenses	UNDERSTANDING
CO3	Acquire a critical knowledge on natural and artificial sources of light and their application in photography.	KNOWLEDGE
CO4	Demonstrate skills of camera usage especially Digital Cameras. To understand the various Image development and editing techniques.	SKILL
CO5	Comprehend the concept of different types of common shooting techniques.	APPLICATION

SYLLABUS:

Unit-I: Introduction to Photography:

Working principle of a camera, Image formation in simple camera and human eye, Types of cameras Pin-hole camera , Single Lens Reflex (SLR) camera, Twin Lens Reflex (TLR) camera , Digital Single-lens reflex camera (DSLR), Digital camera, Drone flying cameras, Care and maintenance of camera.

Unit-II: Digital Photography:

Different types of Digital cameras and their parts, Working of DSLR camera, Types of lenses- Normal, Wide angle, telephoto, Zoom lenses, Digital Image formation, Digital camera image sensors, Size of the image, Depth of focus, Depth of field, Exposure time, Aperture, Shutter speed, ISO, filters, knowledge on pixels and their uses, resolution.

Unit-III: Photographic Light Sources:

Need for the light in photography, Light sources- Natural light, Sun light, Moon light, Ambient light, Artificial light sources-Flood light, Spot light, Halogen light, Halogen flash light, Digital lights, Exposure, Studio photography

Unit-IV: Photographic Shooting Techniques:

Significance and role of Camera lens in photo shooting, Arrangement of lenses in a Camera- Positioning, Techniques involved in the use of DSLR cameras, Usage of Filters, Techniques of Photomicrography, High speed Photography with motor driven camera, Basic ideas on Underwater Photography, Medical Photography, Astronomical Photography.

Unit-V : Photo Manipulation :

Developing and printing the photographs, equipment and materials used in developing and printing, image mixing and printing, Image editing through image editing software's like Adobe Photoshop

– Adjustment of Brightness, Contrast, Tonal and Colour Values, Methods of storing and processing, Image transportation through Pendrive, CD, HDD and CLOUD [Internet]


III Reference Books:

1. Object and image; An introduction to photography by George M Craven, PHI
2. An Introduction to Digital Photo Imaging Agfa, 1994
3. Advance Photography by M. Langford.
4. Digital Photography-A hands on Introduction by Phillip Krejcarek, Delmer Publishers
5. Multimedia – An Introduction by John Villamil, PHI
6. <https://www.adobe.com/in/creativecloud/photography/discover/dslr-camera.html>
7. Web sources suggested by the teacher concerned and the college librarian including reading material.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	1	2	3	3	3	2	2	2	3	2	3	2	3	2	2
CO2	1	2	2	3	2	3	3	1	3	2	2	2	1	2	2	1
CO3	2	2	2	3	3	2	2	2	3	2	2	2	2	3	2	2
CO4	1	2	3	1	2	2	2	3	3	2	3	3S	2	3	2	3

	Government College (Autonomous) Rajahmundry	Program & Semester III B.Sc. (V Sem)			
Course Code 524904	OPTICAL IMAGING AND PHOTOGRAPHY				
Teaching	Hours Allocated: 3 hrs/week (Practical)	L	T	P	C
Pre-requisites:	a) Working principle of a camera , Different types of Digital cameras and their parts, Significance and role of Camera lens in photo shooting ,	0	0	2	1

COURSE OBJECTIVE:

The objective of the practical course on Optical Imaging and Photography is to provide students with hands-on experience and practical skills in capturing, processing, and interpreting optical images using various imaging techniques and equipment. The course aims to develop students' proficiency in operating optical imaging devices, utilizing image processing software, and analyzing images for different applications.

LEARNING OUTCOMES:

On successful completion of this practical course, student shall be able to:


1. List out, identify and understand various image formation techniques including Eye.
2. Learn the procedures of using Analog and Digital cameras.
3. Demonstrate the focusing techniques of Analog and Digital cameras.
4. Acquire skills in the editing and development of photos and videos.
5. Perform some experimental skills related to images, videos using the equipment available in the lab or in a local studio.

Practical (Laboratory) Syllabus:

1. Construction of a simple pin hole Camera and study it's working.
2. Capture an image using a Digital Camera and apply editing techniques.
3. Understanding various image formats and convert one image format into other (For ex: JPEG to BMP)
4. Convert a video stream into image stream by using a suitable editing software.
5. Evaluate the number of pixels and size of digital Image.
6. Comparison of the quality of a 8-bit, 16-bit and 32 bit images.
7. Perform the reduction and enlargement of a given Digital Image.
8. Change the appearance of an image by applying the filters (For ex: from the IR image of the given digital Image by suitable IR filter)

Lab References:

1. DSLR Photography for Beginners by Brian Black
2. The Art of Photography by Bruce Barnbaum
3. Photoshop for Photographers by John Slavio
4. <https://www.youtube.com/channel/UCwWyFRy216aUFMsRemP51Sw>. You Tube resource.

	Government College (Autonomous) Rajahmundry	Program & Semester III B.Sc. (V Sem)			
Course Code 524905	LOW TEMPERATURE PHYSICS & REFRIGERATION				
Teaching	Hours Allocated: 3 hrs/week (Theory)	L	T	P	C
Pre-requisites:	Laws of Thermodynamics, Freezing mixtures, Joule-Thomson effect, Properties of materials at low temperatures	3	0	0	3

COURSE OBJECTIVE:

The objective of the course on Low Temperature Physics & Refrigeration is to provide students with a comprehensive understanding of the fundamental principles, concepts, and applications of low-temperature physics and refrigeration systems. The course aims to develop students' theoretical knowledge and practical skills in working with low temperatures, understanding cryogenic phenomena, and operating refrigeration systems.

LEARNING OUTCOMES:

Students after successful completion of the course will be able to

On Completion of the course, the students will be able to-		COGNATIVE DOMAIN
CO1	Identify various methods and techniques used to produce low temperatures in the Laboratory.	Knowledge
CO2	Acquire a critical knowledge on refrigeration and air conditioning.	Knowledge
CO3	Demonstrate skills of Refrigerators through hands on experience and learns about refrigeration components and their accessories.	skill
CO4	Understand the classification, properties of refrigerants and their effects on environment.	understanding
CO5	Comprehend the applications of Low Temperature Physics and refrigeration.	Application

SYLLABUS:

UNIT-I Production Of Low Temperature

Production of low temperatures-Introduction, Freezing mixtures, Joule-Thomson effect, Regenerative cooling, Different methods of liquefaction of gases, liquefaction of air, Production of liquid hydrogen and nitrogen, Adiabatic demagnetization, Properties of materials at low temperatures

UNIT-II Measurement of Low Temperature

Gas thermometer and its correction and calibration, Secondary thermometers, resistance thermometers, thermocouples, Vapour pressure thermometers, Magnetic thermometers, Advantages and drawbacks of each type of thermometer.

UNIT-III Principles of Refrigeration

Introduction to Refrigeration- Natural and artificial refrigeration , Stages of refrigeration, Types of refrigeration - Vapor compression and vapor absorption refrigeration systems, Refrigeration cycle and explanation with a block diagram, Introductory ideas on air- conditioning.

Refrigerants-Introduction, Ideal refrigerant, Properties of refrigerant, Classification of refrigerants, commonly used refrigerants, Eco-friendly refrigerants

UNIT-IV Components of Refrigerator

Refrigerator and its working, Block diagram, Coefficient of Performance (COP), Tons of refrigeration (TR) and Energy Efficiency Ratio (EER), Refrigerator components: Types of compressors, evaporators, condensers, and their functional aspects, defrosting in a refrigerator, Refrigerant leakage and detection

UNIT-V Applications of Low Temperature & Refrigeration

Applications of Low temperatures: Preservation of biological material, Food freezing, liquid nitrogen and liquid hydrogen in medical field, Superconducting magnets in MRI- Tissue ablation (cryosurgery) - Cryogenic rocket propulsion system.

Applications of refrigeration: Domestic refrigerators, Water coolers, Cold storages, Ice plants, Food preservation methods, Chemical and Process industries, Cold treatment of metals, Construction field, Desalination of water, Data centers.

References

1. Heat and Thermodynamics by Brij Lal & N. Subramanyam, S. Chand Publishers.
2. Thermal Physics by S C Garg, R M Bansal & C K Ghosh, McGrawHill Education, India
3. Heat and Thermodynamics by M M Zemansky, McGrawHill Education (India).
4. Low-Temperature Physics by Christian E. & Siegfried H., Springer.
5. Thermal Engineering by S. Singh, S. Pati, Ch:18 Introduction to Refrigeration.
6. The Physics Hyper Text Book. Refrigerators. <https://physics.info/refrigerators/>



	Government College (Autonomous) Rajahmundry	Program & Semester III B.Sc. (V Sem)			
Course Code 524905	LOW TEMPERATURE PHYSICS & REFRIGERATION				
Teaching	Hours Allocated: 2 hrs/week (Theory)	L	T	P	C
Pre-requisites:	Laws of Thermodynamics, Freezing mixtures, Joule-Thomson effect, Properties of materials at low temperatures	0	0	2	1

COURSE OBJECTIVE:

The objective of the practical course on Low Temperature Physics & Refrigeration is to provide students with hands-on experience and practical skills in working with low temperatures, operating refrigeration systems, and conducting experiments in the field of low temperature physics. The course aims to develop students' proficiency in handling cryogenic equipment, performing temperature measurements, and conducting experiments at low temperatures.

LEARNING OUTCOMES:


On completion of practical course, student shall be able to

On Completion of the course, the students will be able to-		COGNATIVE DOMAIN
CO1	Identify various methods and techniques used to produce low temperatures in the Laboratory.	Knowledge
CO2	Acquire a critical knowledge on refrigeration and air conditioning.	Knowledge
CO3	Demonstrate skills of Refrigerators through hands on experience and learns about refrigeration components and their accessories.	skill
CO4	Understand the classification, properties of refrigerants and their effects on environment.	understanding
CO5	Comprehend the applications of Low Temperature Physics and refrigeration.	Application

Practical (Laboratory) Syllabus: (30 hrs. Max marks:

50)) Record the Principles and applications of Refrigerators and Freezers.

1. Measure the temperatures below Melting point of Ice using a thermometer available in the Lab.
2. Make a freezing mixture by adding different salts viz., Sodium chloride, Potassium Hydrate (KOH), Calcium chloride to ice in different proportions and observe the temperature changes.
3. Study the operation of a refrigerator and understand the working of different parts.
4. Study the properties of refrigerants like chlorofluorocarbons-hydrochlorofluorocarbons and record the lowest temperatures obtained.
5. Consider a simple faulty refrigerator and try to troubleshoot the simple problems by understanding its working.
6. Understand the practical problem of filling the Freon Gas into the Refrigerator.
7. Get the Liquid Nitrogen or Liquid Helium from nearby Veterinary Hospital and measure their temperatures using chromel-alumel thermocouple or mercury

	Government College (Autonomous) Rajahmundry	Program & Semester III B.Sc. (V Sem)			
Course Code 524906	SOLAR ENERGY AND ITS APPLICATIONS				
Teaching	Hours Allocated: 2 hrs/week (Theory)	L	T	P	C
Pre-requisites:	Laws of Thermodynamics, Spectral distribution of solar radiation, Solar constant , zenith angle and Air-Mass, Photovoltaic cell, equivalent circuit, output parameters	3	0	2	3

COURSE OBJECTIVE:

The objective of the course on Solar Energy and Its Applications is to provide students with a comprehensive understanding of solar energy technologies, their principles, and their applications. The course aims to develop students' knowledge and skills in harnessing solar energy for various purposes, including electricity generation, heating, and cooling.

LEARNING OUTCOMES:

After successful completion of the course, the student will be able to:

On Completion of the course, the students will be able to-		COGNATIVE DOMAIN
CO1	Understand Sun structure, forms of energy coming from the Sun and its measurement.	Knowledge
CO2	Acquire a critical knowledge on the working of thermal and photovoltaic collectors.	Knowledge
CO3	Demonstrate skills related to callus culture through hands on experience	skill
CO4	Understand testing procedures and fault analysis of thermal collectors and PV modules.	understanding
CO5	Comprehend applications of thermal collectors and PV modules.	Application

SYLLABUS:

Unit - I: Basic Concepts of Solar Energy

Spectral distribution of solar radiation, Solar constant , zenith angle and Air-Mass, standard time, local apparent time, equation of time, direct, diffuse and total radiations. Pyrheliometer - working principle, direct radiation measurement, Pyranometer-working Principle, diffuse radiation measurement, Distinction between the two meters.

Unit - II: Solar Thermal Collectors

Solar Thermal Collectors-Introduction, Types of Thermal collectors, Flat plate collector – liquid heating type, Energy balance equation and efficiency, Evacuated tube collector, collector overall heat loss coefficient, Definitions of collector efficiency factor, collector heat-removal factor and collector flow factor, Testing of flat-plate collector, solar water heating system, natural and forced circulation types. Concentrating collectors, Solar cookers, Solar dryers, Solar desalinators.

Unit - III: Fundamentals of Solar Cells

Semiconductor interface, Types, homo junction, hetero junction and Schottky barrier, advantages and drawbacks, Photovoltaic cell, equivalent circuit, output parameters, conversion efficiency, quantum efficiency, Measurement of I-V characteristics, series and shunt resistance, their effect on efficiency, Effect of light intensity, inclination and temperature on efficiency


Unit -IV: Types of Solar cells and Modules

Types of solar cells, Crystalline silicon solar cells, I-V characteristics, poly-Si cells, Amorphous silicon cells, Thin film solar cells-CdTe/CdS and CuInGaSe₂/CdS cell configurations, structures, advantages and limitations, Multi junction cells – Double and triple junction cells. Module fabrication steps, Modules in series and parallel, Bypass and blocking diodes

Unit – V: Solar Photovoltaic Systems

Energy storage in PV systems, Energy storage modes, electrochemical storage, Batteries, Primary and secondary, Solid-state battery, Molten solvent battery, lead acid battery and dry batteries, Mechanical storage – Flywheel, Electrical storage – Super capacitor **References:**

1. Solar Energy Utilization by G. D. Rai, Khanna Publishers

	Government College (Autonomous) Rajahmundry	Program & Semester III B.Sc. (V Sem)			
Course Code 524906	SOLAR ENERGY AND ITS APPLICATIONS				
Teaching	Hours Allocated: 2 hrs/week (Practical)	L	T	P	C
Pre-requisites:	Laws of Thermodynamics, Spectral distribution of solar radiation, Solar constant, zenith angle and Air-Mass, Photovoltaic cell, equivalent circuit, output parameters	0	0	2	1

COURSE OBJECTIVE:

The objective of the practical course on Solar Energy and Its Applications is to provide students with hands-on experience and practical skills in working with solar energy systems, performing measurements and analysis, and implementing solar energy projects. The course aims to develop students' proficiency in solar energy system installation, maintenance, performance analysis, and practical application.

LEARNING OUTCOMES:

On successful completion of this practical course, students shall be able to:

1. List out and identify various components of solar thermal collectors and systems, solar photovoltaic modules and systems.
2. Learn the procedures for measurement of direct, global and diffuse solar radiation, I-V characteristics and efficiency analysis of solar cells and modules.
3. Demonstrate skills acquired in evaluating the performance of solar cell / module in connecting them appropriately to get required power output.
4. Acquire skills in identification and elimination of the damaged panels without affecting the output power in a module / array.
5. Perform procedures and techniques related to general maintenance of solar thermal and photovoltaic modules.

Practical (Laboratory) Syllabus:

1. Measurement of direct radiation using pyrheliometer.
2. Measurement of global and diffuse radiation using pyranometer.
3. Evaluation of performance of a flat plate collector
4. Evaluation of solar cell / module efficiency by studying the I – V measurements.
5. Determination of series and shunt resistance of a solar cell / module.
6. Determination of efficiency of two solar cells / modules connected in series.
7. Determination of efficiency of two solar cells / modules connected in parallel.
8. Study the effect of input intensity on the performance of solar cell / module.
9. Study the influence of cell / module temperature on the efficiency.
10. Study the effect of cell / module inclination on the efficiency.

Lab References:

1. Solar Photo voltaic- Alab training manual, C.S. Solanki et al., Foundation Books Publishers, 2012.