MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Physics **Semester: I**
Course Title: Mechanics, Waves & Oscillations
Course Code: 20PHCCMW13
No. of Hours: 60 **LTP: 400** **Credits: 3**

Objectives

- To impart knowledge in the mechanics of particles & rigid bodies, central forces, basic concepts of relativity, ultrasonics and its applications.
- To facilitate students to learn the fundamentals of vibrations, damped and forced oscillations and vibrating strings.
- To provide experiential learning through discussions and demonstration of simple experiments.

Course Outcomes

CO 1: Describe motion of rockets and their applications.
CO 2: Outline the concepts of central forces and the basics of global positioning system.
CO 3: Explain the postulates and various concepts of theory of relativity
CO 4: Distinguish undamped, damped and forced oscillations, concepts of resonance and quality factor.
CO 5: Explain harmonics and overtones in a stretched string, basics of ultrasonics, and their applications in life.

UNIT-I: Mechanics of Particles **(10 Hrs.)**

Review of Newton's laws of motion, motion of variable mass system, Motion of a rocket, multistage rocket.

Mechanics of Rigid bodies

Rigid body, rotational kinematic relations, equation of motion for a rotating body, angular momentum precession of a spinning top, Gyroscope, Precession of the equinoxes.

UNIT-II: Motion in a Central Force Field **(10 Hrs.)**

Central forces, definition and examples, characteristics of central

forces, conservative nature of central forces, Equation of motion under a central force, Kepler's laws of planetary motion- Proofs (qualitatively), Motion of satellites, Basic idea of Global Positioning System (GPS), weightlessness, Physiological effects of astronauts.

UNIT-III: Relativistic Mechanics **(8 Hrs.)**

Absolute frames, Michelson-Morley experiment– significance of negative result, constancy of speed of light, postulates of special theory of relativity-Lorentz transformations, time dilation, length contraction, derivation of mass-energy relation.

UNIT-IV: Undamped, Damped and Forced Oscillations **(10 Hrs.)**

Simple harmonic oscillator and solution of the differential equation, Damped harmonic oscillator, Forced harmonic oscillator – Their differential equations and solutions, Resonance, Logarithmic decrement, Relaxation time and Quality factor (Qualitatively).

UNIT-V: Vibrating Strings: **(10 Hrs.)**

General solution of wave equation and its significance, Transverse wave propagation along a stretched string, Modes of vibration of stretched string clamped at ends, overtones and harmonics, Melde's strings.

Ultrasonics:

Ultrasonics, General Properties of ultrasonic waves, Production of ultrasonics by piezoelectric and magnetostriction methods, Detection of ultrasonics, Applications of ultrasonic waves, SONAR.

Hands on / Skill based learning **(12 Hrs.)**

1. A debate / discussion on
   - "Is Rocket Technology a true symbol of societal development /
   - prestigious status?".
   - "Space Exploration vs Societal Concerns"
   - "The role of linear motion / rotatory motion in life"
   - "The dominant force in the universe is Central force / Gravitational force"
   - "The role of Ultrasonics Vs Supersonics in life"
   - Videos on 'Physiological effects of astronauts in space shuttle".

2. Simple experimental demonstrations
   - Transfer of momentum using simple pendulum bobs
   - Spin and Precession using glass, straw and a paddle wheel
   - Gyration motion using a wheel and impact of torque on it
   - Pendulum waves
   - Forced oscillations and resonance
   - Standings waves
   - Dependence of wave pattern on frequency and length

Prescribed Text Book

1. Unified Physics: Mechanics by Dr.S.L. Gupta and Sanjeev Gupta, Jai Prakash Publications

Reference Books:

1. B. Sc. Physics, Vol.1, Telugu Academy, Hyderabad
2. Fundamentals of Physics Vol. I - Resnick, Halliday, Krane ,Wiley India2007
3. College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House.
4. University Physics-FW Sears, MW Zemansky & HD Young, Narosa Publications, Delhi.
5. Mechanics, S.G.Venkatachalapathy, Margham Publication,2003.
6. Waves and Oscillations. N. Subramanyam and Brijlal,Vikas Pulications.
7. Unified Physics - Waves and Oscillations, JaiPrakash Nath&Co.Ltd.
8. Waves & Oscillations. S.Badami, V. Balasubramanian and K.R. Reddy, Orient Longman.
9. The Physics of Waves and Oscillations, N.K.Bajaj, Tata McGrawHill
10. Science and Technology of Ultrasonics- Baldevraj, Narosa, NewDelhi,2004

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
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PRACTICAL SYLLABUS

Subject: Physics **Semester: I**
Course Title: Mechanics, Waves & Oscillations-Practical
Course Code: 20PHP1MW12
No. of Hours: 30 **LTP: 002** **Credits: 2**

Objectives

- To learn operation of basic measuring instruments
- To determine viscosity, Young's Modulus, rigidity modulus of given material

Course Outcomes

CO1: List out, identify and handle various instruments related to Mechanics, Waves & Oscillations.

CO2: Describe the operational procedures of various experiments in Mechanics, Waves & and Oscillations..

CO3: Demonstrate experimental skills and determine the respective physical parameters.

List of experiments

1. Measurements of length (or diameter) using Vernier caliper, screw gauge and Travelling microscope (Preliminary experiment).
2. Young's Modulus material of a rod by uniform bending.
3. Volume resonator experiment.
4. Determination of frequency of a bar –Melde's experiment.
5. Rigidity Modulus of material of a wire – dynamic method (torsional Pendulum)
6. Viscosity of liquid by the flow method (Poiseuille's method).
7. Simple Pendulum by method of errors.

Reference Books:

1. B.Sc Practical Physics, Harnam Singh, Dr.P.S. Hemne, S.Chand.
2. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann Educationa lPublishers.
4. Engineering Practical Physics, S.Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd.
5. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11thEdition, 2011, KitabMahal, NewDelhi.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
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SYLLABUS

Subject: Physics **Semester: II**
Course Title: Wave Optics **Course Code: 20PHCCWO23**
No. of Hours: 60 **LTP: 400** **Credits: 3**

Objectives

- To impart knowledge in the areas of aberrations in optics, various phenomena of light.
- To facilitate students to learn the basic concepts of LASERS, holography and fiber optics and their applications.
- To provide experimental exposure to optical fibres and LASERS.

Course Outcomes

CO1:Explain the principles and theory of interference and its applications.
CO2:Distinguish between the concepts of Fraunhofer and Fresnel diffraction.
CO3:Summarize the concepts of polarization, specific rotation and applications.
CO4:Relate different types of aberrations in lenses, minimizing techniques and fundamentals of fiber optics.
CO5:Outline the characteristics, working principles of LASERS and Holography and their applications.

UNIT-I: Interference of light **(10 Hrs.)**

Introduction, conditions for interference of light, Phase change on reflection- Stokes' treatment, Interference using wedge- shaped films, colours in thin films, Newton's rings in reflected light-theory and experiment, determination of wavelength of monochromatic light, Michelson interferometer and determination of wavelength.

UNIT-II: Diffraction of light **(10 Hrs.)**

Introduction, Types of diffraction: Fresnel and Fraunhoffer diffractions, Distinction between Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction at a single slit, Plane diffraction grating (N slits) &

determination of wavelength of light, Fresnel's half period zones, Zone plate, comparison of zone plate with convex lens.

UNIT-III: Polarization of light **(10 Hrs.)**

Polarized light: Methods of production of plane polarized light, Double refraction, Brewster's law, Malus law, Nicol prism, Nicol prism as polarizer and analyzer, Quarter wave plate, Half wave plate, polaroid, optical activity, Laurent's half shade polarimeter: determination of specific rotation, basic principle of LCDs.

UNIT-IV: Aberrations and Fibre Optics **(10 Hrs.)**

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.

Fibre optics: Introduction to Fibers, different types of fibers, rays and modes in an optical fiber, Principles of fiber communication (qualitative treatment only), Advantages of fiber optic communication.

UNIT-V: Lasers and Holography **(8 Hrs.)**

Lasers: Introduction, Spontaneous emission, stimulated emission, Population Inversion, Laser principle, Types of lasers-He-Ne laser, Ruby laser, Applications of lasers.

Holography: Basic principle of holography, Applications of holography.

Hands on / Skill based learning (12 Hrs.)

1. An experiment measuring the numerical aperture of an optical fiber
2. Determination of the Wavelength of LASER source using Grating.
3. Determination of particle size.

Prescribed Text Book

1. Unified Physics: Optics by Dr.S.L. Gupta and Sanjeev Gupta, Jai Prakash Publications.

Reference Books

1. BSc Physics, Vol.2, Telugu Akademy, Hyderabad.
2. A Text Book of Optics-N Subramanyam, L Brijlal, S.Chand&Co.
3. Optics-Murugeshan, S.Chand&Co.
4. Optics,F.A. Jenkins and H.G.White,McGraw-Hill
5. Optics,AjoyGhatak,TataMcGraw-Hill.
6. Introduction of Lasers – Avadhanulu, S.Chand&Co.
7. Principles of Optics- BK Mathur, Gopala Printing Press,1995

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PRACTICAL SYLLABUS

Subject: Physics **Semester: II**
Course Title: Wave Optics-Practical **Course Code: 20PHP2WO22**
No. of Hours: 30 **LTP: 002** **Credits: 2**

Objectives

- To learn operation of instruments like spectrometer, microscope etc.
- To determine thickness of a thin paper, dispersive power of the prism, radius of curvature of a lens, wavelength of mercury spectrum, and refractive index of the liquid.

Course Outcomes

CO1: List out, identify and handle various optical instruments.
CO2: Describe the operational procedures of various experiments in Wave Optics.
CO3: Demonstrate experimental skills and determine the respective physical parameters.

Minimum of 6 experiments to be done and recorded

1. Determination of radius of curvature of a given convex lens-Newton's rings.
2. Dispersive power of a prism.
3. Determination of wavelength of light using diffraction grating-minimum deviation method.
4. Refractive index of a liquid-hollow prism
5. Determination of refractive index of liquid-Boy's method.
6. Determination of thickness of a thin wire by wedge method.
7. Determination of wavelength of light using diffraction grating-Normal Incidence method.

Reference Books:

1. B.Sc Practical Physics, Harnam Singh, Dr.P.S. Hemne, S.Chand.
2. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann EducationalPublishers.
4. Engineering Practical Physics, S.Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd.
5. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11thEdition, 2011, KitabMahal, NewDelhi.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
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SYLLABUS

Subject: Physics **Semester: III**
Course Title: Heat & Thermodynamics **Course Code: 20PHCCHT33**
No. of Hours: 60 **LTP: 400** **Credits: 3**

Objectives

- To impart knowledge in transport phenomena, thermodynamic concepts and potentials, low temperature physics and Quantum theory of radiation and their applications.
- To provide experiential learning by performing concept based experiments.

Course Outcomes

CO1: Describe the postulates of kinetic theory of gases and transport phenomena.
CO 2: Outline the fundamental ideas, laws of thermodynamics, reversible and irreversible processes, entropy of the universe and their applications.
CO 3: Describe thermodynamic potentials and derive Maxwell's equations and their applications.
CO 4: Summarize the fundamentals of low temperature physics and their applications
CO 5: Discuss the postulates of Quantum theory of radiation and their applications.

UNIT-I: Kinetic Theory of gases **(9 Hrs.)**

Kinetic Theory of gases-Introduction, Maxwell's law of distribution of molecular velocities (qualitative treatment only) and its experimental verification, Mean free path, Transport phenomenon in ideal gases: viscosity, Thermal conductivity and diffusion of gases.

UNIT-II: Thermodynamics **(9 Hrs.)**

Introduction- Isothermal and Adiabatic processes, Reversible and irreversible processes, Carnot's engine and its efficiency, Carnot's theorem, Thermodynamic scale of temperature and its identity with perfect gas scale, Second law of thermodynamics: Kelvin's and

Clausius statements, Principle of refrigeration, Entropy, Physical significance, Change in entropy in reversible and irreversible processes; Entropy and disorder-Entropy of Universe; Temperature-Entropy (T-S) diagram and its uses ; change of entropy when ice changes into steam.

UNIT-III: Thermodynamic Potentials and Maxwell's equations (9 Hrs)
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 (9 Hrs.)
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), Practical applications of substances at low temperatures.

UNIT-V: Quantum theory of radiation (9 Hrs.)
Blackbody and its spectral energy distribution of black body radiation, Kirchoff's law, Wein's displacement law, Stefan-Boltzmann's 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 pyroheliometer, Estimation of surface temperature of Sun.

Skills through Hands on experience: (15 Hrs.)

- **Assignments**
  1. Applications of Cryogenics in space and medical fields.
  2. Entropy of Universe, Climate Change and consequences
- **Discussion**
  Applications of Transport phenomena in
  1. Meteorology
  2. Space Physics

Prescribed Textbook

Unified Physics: Heat and Thermodynamics by Dr.S.L. Gupta and Sanjeev Gupta, Jai Prakash Nath Publications, Meerut.

Reference Books:

1. BSc Physics, Vol.2, Telugu Akademy, Hyderabad
2. Thermodynamics, R.C.Srivastava, S.K.Saha&AbhayK.Jain, Eastern EconomyEdition.
3. Unified Physics Vol.2, Optics & Thermodynamics, Jai PrakashNath&Co.Ltd.,Meerut
4. Fundamentals of Physics. Halliday/Resnick/Walker.C. Wiley India Edition2007
5. Heat and Thermodynamics -N BrijLal, P Subrahmanyam, S.Chand&Co.,2012
6. Heat and Thermodynamics- MS Yadav, Anmol Publications Pvt. Ltd,2000
7. University Physics, HD Young, MW Zemansky,FW Sears, Narosa Publishers, New Delhi

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PRACTICAL SYLLABUS

Subject: Physics **Semester: III**
Course Title: Heat &Thermodynamics-Practical
Course Code: 20PHP3HT32
No. of Hours: 30 **LTP: 002** **Credits: 2**

Objectives

- To impart experimental skills
- To provide exposure to experiential learning of basic theoretical concepts by performing experiments.

Course Outcomes

CO1: List out, identify and handle various instruments related to Heat &Thermodynamics.

CO2: Describe the operational procedures of various experiments in Heat &Thermodynamics.

CO3: Demonstrate experimental skills and determine the respective physical parameters.

List of Experiments

1. Thermal conductivity of bad conductor-Lee's method
2. Heating efficiency of electrical kettle with varying voltages.
3. Thermal behavior of an electric bulb (filament/torch light bulb)
4. Study of variation of resistance with temperature -Thermistor.
5. Thermal conductivity of copper- Searl's apparatus.
6. Mechanical equivalent of heat - Calender Barne constant flow apparatus.

Reference Books:

1. B.Sc Practical Physics, Harnam Singh, Dr.P.S. Hemne, S.Chand.
2. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann EducationalPublishers.
4. Engineering Practical Physics, S.Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd.
5. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11thEdition, 2011, KitabMahal, NewDelhi.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
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SYLLABUS

Subject: Physics **Semester: IV**
Title: Electricity, Magnetism & Electronics
Course Code: 20PHCCEM43
No. of Hours: 60 **LTP: 400** **Credits: 3**

Objectives

- To impart knowledge on the basic principles of electricity, magnetism and electronics and their impact in providing solutions to electrical and communications needs.
- To provide experiential learning by performing concept based experiments.

Course Outcomes

CO1: Apply Gauss's law to get relations connecting dielectric parameters and their applications.
CO2: Derive expressions for magnetic field at a point due to current carrying conductors using Biot Savart Law.
CO3: Distinguish self and mutual inductance phenomena and their real time applications.
CO4: Compute Maxwell's electromagnetic wave equations and their role in communications.
CO5: Summarize the basic concepts of semiconductors and digital electronics and their applications.

UNIT-I: Electrostatics **(9 Hrs.)**

Gauss's law-Statement and its proof, Electric field intensity due to (i) uniformly charged (ii) solid sphere and Deduction of Coulomb's law from Gauss law, Electrical potential–Equipotential surfaces, Potential due to a (i) dipole (ii) uniformly charged sphere.

Dielectrics:

Dielectrics-Polar and Non-polar dielectrics- Effect of electric field on dielectrics, Dielectric strength, Electric displacement D, electric polarization P, Relation between D, E and P, Dielectric constant and electric susceptibility.

UNIT-II: Magnetostatics: **(9 Hrs.)**

Biot-Savart's law and its applications: (i) circular loop and (ii) solenoid, Divergence and curl of magnetic field, 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, Mutual inductance of two coils, Energy stored in magnetic field.

UNIT-III: Alternating currents: **(9 Hrs.)**

Alternating current - Relation between current and voltage in LR and CR circuits, LCR series and parallel resonant circuit, Q –factor, Power in ac circuits, Power factor.

Electromagnetic waves-Maxwell's equations:

Maxwell's equations-Derivation, Maxwell's wave equation (with derivation), Transverse nature of electromagnetic waves, Poynting theorem (Statement and proof)

UNIT-IV: Basic Electronic devices: **(9 Hrs.)**

Zener diode and Light Emitting Diode (LED. and their I-V characteristics, Zener diode as a regulator- Transistors and its operation, CB, CE and CC configurations, Input and output characteristics of a transistor in CE mode, Relation between alpha, beta and gamma; Hybrid parameters, Determination of hybrid parameters from transistor characteristics; Transistor as an amplifier.

UNIT-V: Digital Electronics: **(9 Hrs.)**

Number systems, Conversion of binary to decimal system and vice versa, Laws of Boolean algebra, De Morgan's laws-Statements and Proofs, Basic logic gates, NAND and NOR as universal gates, Exclusive-OR gate, Half adder and Full adder circuits.

Skills through Hands on experience: (15 hrs)

1. Study of voltage regulation using Zener diode.
2. Discussion on applications of eddy currents and electromagnetic damping.
3. Demonstration of self and mutual induction using inductance coils and B.G.
4. Study of growth and decay of charge in a CR circuits.
5. Logic Gates- OR, AND, NOT and NAND gates. Verification of Truth Tables.
6. NAND and NOR as universal gates.
7. Efficiency of a transformer.

Prescribed Text book:

Unified Physics: Electricity, magnetism and Electronics by S.L. Gupta and Sanjeev Gupta, Jai Prakash Nath Publications, Meerut.

Reference books

1. BSc Physics, Vol.3, Telugu Akademy, Hyderabad.
2. Electricity and Magnetism, D.N. Vasudeva. S. Chand & Co.
3. Electricity and Magnetism, B.D.Duggal and C.L.Chhabra. Shobanlal& Co.
4. Electricity, Magnetism with Electronics, K.K.Tewari, R.Chand& Co.,
5. Electricity and Magnetism, R.Murugeshan, S. Chand & Co.
6. Principles of Electronics, V.K. Mehta, S.Chand& Co.,
7. Digital Principles and Applications, A.P. Malvino and D.P.Leach, McGrawHill Edition.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
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SYLLABUS

Subject: Physics **Semester: IV**
Course Title: Electricity, Magnetism & Electronics- Practical
Course Code: 20PHP4EM42
No. of Hours: 30 **LTP: 002** **Credits: 2**

Objectives

- To impart experimental skills
- To provide exposure to experiential learning of basic theoretical concepts by performing experiments.

Course Outcomes

CO1: List out, identify and handle various instruments related to Electricity, Magnetism & Electronics.

CO2: Describe the operational procedures of various experiments in Electricity, Magnetism & Electronics.

CO3: Demonstrate experimental skills and determine the respective physical parameters.

List of Experiments

1. LCR circuit series/parallel resonance, Q factor.
2. Field along the axis of a circular coil carrying current-Stewart & Gee's apparatus.
3. Zener Diode –V-I Characteristics
4. Transistor CE Characteristics- Determination of hybrid parameters
5. Verification of De Morgan's Theorems.
6. Construction of Half adder and Full adders-Verification of truth tables

Reference Books:

1. B.Sc Practical Physics, Harnam Singh, Dr.P.S. Hemne, S.Chand.
2. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educationa lPublishers.
4. Engineering Practical Physics, S.Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd.
5. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, KitabMahal, NewDelhi.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
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SYLLABUS

Subject: Physics **Semester: IV**
Course Title: Modern Physics **Course Code: 20PHCCMP43**
No. of Hours: 60 **LTP: 400** **Credits: 3**

Objectives

- To impart basic knowledge in the areas Atomic physics, Molecular Physics, Quantum mechanics, Nuclear Physics, Nanomaterials and Superconductivity and applications.
- To expose to experiential learning through virtual tour to CERN lab.

Course Outcomes

CO1: Apply the knowledge of vector atom model to explain various experiments and their applications in Atomic & Molecular Physics.
CO2: Relate the applications of de Broglie concept of matter waves and Heisenberg's uncertainty Principle in Modern scientific fields.
CO3: Describe the energies and wave functions of a particle in a one dimensional potential box of infinite height using Schrodinger wave equation.
CO4: Summarize the general properties of nuclei and radioactivity decays in Nuclear Physics.
CO5: Outline the basics of Nanomaterials and the phenomenon of Superconductivity and its applications.

UNIT-I:Atomic and Molecular Physics **(9 Hrs.)**

Vector atom model and Quantum numbers associated with it, Stern-Gerlach experiment, Angular momentum of the atom, Coupling schemes, Spectral terms and spectral notations, Selection rules, Intensity rules, Fine structure of Sodium D-lines, Zeeman effect, Experimental arrangement to study Zeeman effect; Raman effect, Characteristics of Raman effect, Experimental arrangement to study Raman effect, Quantum theory of Raman effect, Applications of Raman effect.

UNIT-II: Matter waves &Uncertainty Principle (9 Hrs.)

Matter waves, de Broglie's hypothesis, Wave length of matter waves, Properties of matter waves, Davisson and Germer's experiment, Heisenberg's uncertainty principle for position and momentum & energy and time, Illustration of uncertainty principle using diffraction of beam of electrons (Diffraction by a single slit) and photons(Gamma ray microscope),Bohr's principle of complementarity.

UNIT-III: Quantum (Wave) Mechanics (9Hrs.)

Basic postulates of quantum mechanics, Schrodinger time independent and time dependent wave equations-Derivations, Physical interpretation of wave function, Eigen functions, Eigen values, Application of Schrodinger wave equation to one dimensional potential box of infinite height (Infinite Potential Well)

UNIT-IV: Nuclear Physics (9Hrs.)

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, The Shell model, Magic numbers; Nuclear Radiation detectors: G.M. Counter, Cloud chamber, Solid State detector.

UNIT-V: Nano materials (9Hrs.)

Nanomaterials – Introduction, Electron confinement, Size effect, Surface to volume ratio, Classification of nano materials– (0D, 1D, 2D.; Quantum dots, Nano wires, Fullerene, CNT, Graphene (Mention of structures and properties),Distinct properties of nano materials (Mention-mechanical, optical, electrical, and magnetic properties); Mention of applications of nano materials: (Fuel cells, Phosphors for HD TV, Next Generation Computer chips, elimination of pollutants, sensors)

Superconductivity:

Introduction to Superconductivity, Experimental results-critical temperature, critical magnetic field, Meissner effect , Isotope effect, Type I and Type II superconductors, BCS theory (elementary ideas only), Applications of superconductors.

Hands on / Skill based learning **(12 Hrs.)**

Assignments/Seminars on research work at the European Organization for Nuclear Research (CERN) laboratory:

1. Particle accelerator facilities that enable research at the forefront of human knowledge.
2. World-class research in fundamental physics
3. A virtual tour of The Large Hadron Collider (LHC): the world's largest and most powerful particle accelerator, Facts and Figures
4. A range of experiments at CERN investigate physics from cosmic rays to supersymmetry
5. Medical & Biomedical Technologies, Aerospace Applications Safety, Environment, Industry 4.0, Cultural Heritage & Emerging Technologies and other Success Stories

Prescribed text book

Unified Physics: Modern Physics by S.L. Gupta and Sanjeev Gupta, Jai Prakash Nath Publications, Meerut.

Reference books

1. BSc Physics, Vol.4, Telugu Akademy, Hyderabad
2. Atomic Physics by J.B. Rajam; S.Chand& Co.,
3. Modern Physics by R. Murugeshan and Kiruthiga Siva Prasath. S. Chand & Co.
4. Concepts of Modern Physics by Arthur Beiser. Tata McGraw-HilEdition.
5. Nuclear Physics, D.C.Tayal, Himalaya Publishing House.
6. S.K. Kulkarni, Nanotechnology: Principles & Practices(CapitalPubl.Co.)
7. K.Chattopadhyay&A.N.Banerjee, Introd.to Nanoscience and Technology(PHI LearningPriv.Limited)..
8. Nano materials, A K Bandopadhyay. New Age International Pvt. Ltd. (2007)
9. Textbook of Nanoscience and Nanotechnology, BS Murthy, P Shankar, Baldev Raj,BB Rath and J Murday-Universities Press-IIM

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
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PRACTICAL SYLLABUS

Subject: Physics **Semester: IV**
Course Title: Modern Physics-Practical **Course Code: 20PHP5MP42**
No. of Hours: 30 **LTP: 002** **Credits: 2**

Objectives

- To impart experimental skills
- To provide exposure to experiential learning of basic theoretical concepts by performing experiments.

Course Outcomes

CO1: List out, identify and handle various instruments related to Modern Physics.

CO2: Describe the operational procedures of various experiments in Modern Physics.

CO3: Demonstrate experimental skills and determine the respective physical parameters.

List of Experiments

1. Determination of Planck's constant (photocell).
2. Verification of inverse square law of light using Photovoltaic cell.
3. Determination of the Planck's constant using LEDs of at least 4 different colours.
4. Determination of M & H.
5. Energy gap of a semiconductor using junction diode.
6. Energy gap of a semiconductor using thermistor

Reference Books:

1. B.Sc Practical Physics, Harnam Singh, Dr.P.S. Hemne, S.Chand.
2. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann Educationa lPublishers.
4. Engineering Practical Physics, S.Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd.
5. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11thEdition, 2011, KitabMahal, NewDelhi.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA - 8
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SYLLABUS

Subject: Physics **Semester: V/VI**
Course Title: Optical Instruments & Optometry
Course Code: 20PHSEC11OI3
No. of Hours: 45 **LTP 300** **Credits: 3**

Objectives

To enable learners to acquire knowledge on: Working of normal and research based microscopes & Telescopes, Optical Vision, formation of image in the eye and the camera, types of contact lenses, eye disorders and principles of Computer based eye testing.

Course Outcomes

CO1: Summarize the construction and working principles of various optical instruments.

CO2: Explain the various defects of eye and their correcting methods with suitable Lenses.

CO3: Demonstrate experimental skills by performing experiments using microscope and telescope.

CO4: Outline the various techniques used in optometry and computer based eye testing.

CO5: Comprehend the various applications of microscopes and telescopes.

Unit-I: Optical Microscopes **(9 Hrs.)**

Introduction to Microscopes, Need of a Microscope, Different types of microscopes and their uses, 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 **(9 Hrs.)**

Introduction to Telescopes, Different types of Telescopes and their uses, 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 (9 Hrs.)

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 (vi) X-ray telescope and (vii) Gamma ray telescope.

Unit-IV: Optical Vision (9 Hrs.)

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

Unit-V: Ophthalmic Techniques and Optometry (9 Hrs.)

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, Checking the power of lenses, Principles of Computer based eye testing

Co-Curricular Activities

1. Familiarization of various optical instruments available in the laboratory.
2. Seminars using PPTs /videos on construction of different types of telescopes and their comparison in construction, operation and their utility and limitations.
3. Seminars using videos on tools and techniques in optical instruments and optical lenses, contact lenses.
4. Technical assignments like identifying tools in the lens grinding, frame fitting, lens cleaning culture and other operational techniques with safety and security, IPR
5. Invited lectures and presentations on related topics by field /industrial experts.
6. a. Making a model microscope and measuring its magnification.

b. Making a simple astronomical telescope using two convex lenses.

c. Making a simple binoculars

- https://paksc.org/pk/science-experiments/physics-experiments/how-to-make-astronomical- telescope
- https://kids.nationalgeographic.com/nature/article/make-a-telescope
- https://learning-center.homesciencetools.com/article/how-to-make-a-telescope-optical- science-project/
- http://scipop.iucaa.in/Amateurs/telemaking.html

Prescribed Textbook

A Text Book of Optics by Brj Lal and N.Subramanyam, S.Chand & Co.

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. Practical Optics by Menn Naftly, Elsevier Science Publishing.
4. Applications of Optics in daily life | CK-12 Foundation. https://flexbooks.ck12.org ›
5. Web sources suggested by the teacher concerned and the college librarian including Reading material.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
(Affiliated to Krishna University, Machilipatnam)

PRACTICAL SYLLABUS

Subject: Physics **Semester: V/VI**
Course Title: Optical Instruments & Optometry-Practical
Course Code: 20PHP611OI2
No. of Hours: 30 **LTP: 002** **Credits: 2**

Objectives

- To impart experimental skills
- To provide exposure to experiential learning of basic theoretical concepts by performing experiments using microscopes, telescopes.

Course Outcomes

CO1: List out, identify and handle various optical instruments.
CO2: Describe the operational procedures of various experiments in Optical Instruments & Optometry .
CO3: Demonstrate experimental skills and determine the respective physical parameters.

List of Experiments

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

Reference Books:

1. A Practical Guide to Experimental Geometrical Optics byYuriy A. Garbovskiy- Cambridge Univ. Press
2. https://physics.columbia.edu/sites/default/files/content/Lab%20Resources/1292% 20Lab %20Manual.pdf
3. https://www.lnmiit.ac.in/Department/Physics/uploaded_files/lab-manual.pdf
4. Basic Optics Experiments -http://www.phys.unm.edu › Optics Lab › Basics

5. A Practical Guide to Experimental Geometrical Optics by Yuriy A. Garbovskiy, Anatoliy V. Glushchenko, Cambridge Univ. Press
6. Web sources suggested by the teacher concerned.
   http://www.phy.olemiss.edu/~thomas/weblab/Optics_lab_Items/Telescope_Microscope_PROCED_Spring_2018.pdf

➢ **Skills through Hands on experience on any of the following: (15 Hrs.)**

1. Skills on the familiarization of various optical instruments available in the laboratory.
2. Construction of different types of telescopes and their comparison in construction, operation and their utility and limitations using videos.
3. Study of various defects in the eye sight, emerging techniques in the design of eye lenses including contact lenses.
4. Making a model microscope and measuring its magnification.
5. Making a simple astronomical telescope using two convex lenses.
6. Checking the power of your spectacles or lenses at home.
7. Making a model (i) Telescope and (ii) Binoculars with the accessories available at home.

➢ **Field visits to any of the following:**

1. A visit to local optician to understand the various types of eye lenses and designing of contact lenses.
2. A visit to local computer based eye testing centre.
3. A visit to medical lab and study the testing techniques of a biological sample using a clinical microscope

- Submission of a report on Fieldwork not exceeding 10 pages in the given format to the teacher on any one of the above.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA - 8
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SYLLABUS

Subject: Physics **Semester: V/VI**
Course Title: Optical Imaging & Photography
CourseCode: 20PHSEC12OP3
No. of Hours: 45 **LTP: 300** **Credits: 3**

Objectives

To enable learners to acquire knowledge on: Working principle of a camera, Image formation, types of cameras, their accessories, natural and artificial light sources, photo shooting, techniques of various photography, printing, image mixing, editing, methods of storing, processing, and image transportation.

Course Outcomes

CO1: Identify different types of cameras and camera lenses according to different purposes.
CO2: Determine focal length of the different types of lenses.
CO3: Outline the natural and artificial sources of light and their application in Photography.
CO4: Demonstrate skills on camera usage especially Digital Cameras.
CO5: Outline the concept of different shooting techniques, techniques of Image development and editing.

Unit-I: Introduction to Photography **(9 Hrs.)**

Photography-Introduction, 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, Factors influencing choice of camera

Unit-II: Digital Photography **(9 Hrs.)**

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, Camera accessories

Unit-III: Photographic Light Sources **(9 Hrs.)**

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 **(9 Hrs.)**

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, Infra-Red (IR) Photography, Ultra Violet (UV) Photography and Forensic Photography.

Unit-V: Photo Manipulation **(9 Hrs.)**

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, Factors influencing quality of digital image, Methods of storing and processing, Image transportation through Pendrive, CD, HDD and CLOUD [Internet]

➢ **Co-Curricular Activities**

1. Seminars using PPTs /videos on the construction, operation and the Physics principles involved in a normal Camera and Digital Camera.
2. Seminars using videos on tools and techniques related to Image formation and Photographic Techniques.
3. Seminars using videos on the tools & techniques involved in photography using different Cameras with safety and security.
4. Invited lectures and presentations on related topics by field /industrial experts.
5. a. Practice taking outdoor photographs with a digital camera in (i) Black & White and (ii) Colour in the following conditions: Landscapes – Street / Building – Sculpture – Insect / Animal movement – Industrial plant (outside view) – Children, birds (close up / long shot / model photography)- slow and fast moving objects- Night photography etc.

6. Shooting of different areas and topics such as sports, wildlife, modeling, drama, documentary, serial, story board making, news, interview, seminar/ workshop, industrial, live broadcasting, musical event, advertisement, etc.
7. Collection of material/figures/photos related to various components of a Camera, writing and organizing them in a systematic way in a file.

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.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
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PRACTICAL SYLLABUS

Subject: Physics **Semester: V/VI**
Course Title: Optical Imaging & Photography-Practical
Course Code: 20PHP712OP2
No. of Hours: 30 **LTP: 003** **Credits: 2**

Objectives

- To impart experimental skills
- To provide exposure to experiential learning of basic theoretical concepts by performing experiments using Analog and Digital cameras.

Course Outcomes

CO1: List out, identify and handle various instruments related to optical imaging and Photography.

CO2: Describe the operational procedures of various experiments in Optical Imaging & Photography.

CO3: Demonstrate experimental skills and determine the respective physical parameters.

List of Experiments (any six experiments)

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)

Reference Books:

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/UCwWyFRy2l6aUFMsRemP51Sw. You Tube resource.
5. https://www.udemy.com/course/complete-photography-course/
6. Web sources suggested by the teacher concerned.
7. Web sources suggested by the teacher concerned.

Skills through Hands on experience on any of the following: (15 Hrs.)

Familiarization of Image formation by using lenses and mirrors available in the laboratory.

➢ **Field visits to any of the following:**

Individual visit a local Photo studio or any such facility in a university/research organization/private and observe:

(i) the operation of different digital cameras, compact and SLR and in taking photographs using different types of lenses by varying aperture, shutter speed for still camera, video camera, CCTV and spy camera.

(ii) the use of natural light, tungsten light, fluorescent light, electronic flash reflectors, exposure meters, studio flash and its accessories.

(iii) the usage of various lighting techniques for different lenses and will

do practice on special areas of photography in outdoor and indoor conditions

(iv) the different processes viz., audio video recording, mixing, editing, dubbing of sound, using different types of microphones

(v) the handling of the digital video cameras, DVD, HDD, accessories and exposure to take different common shots, dimension of images and movements as per requirement

(vi) the computer system with digital editing software, printing the photographs taken by digital cameras and the image transportation to the storage media, sending photographs through E- mail and Scanning the photographs, capture frames and analysis of images and record their observation.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA - 8
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SYLLABUS

Subject: Physics **Semester: V/VI**
Course Title: Low Temperature Physics & Applications
Course Code: 20PHSEC21LT3
No. of Hours: 45 **LTP 300** **Credits: 3**

Objectives

To enable learners to acquire knowledge on: Production and measurement of low temperatures, principles of refrigeration, working of refrigerators, Air-Conditioning and Cold storage techniques, and applications of low temperature in day to day life.

Course Outcomes

CO1: Summarize the procedures of various methods and techniques used to produce low temperatures in the Laboratory.
CO2: Explain the principles of refrigeration, air conditioning and cold storage.
CO3: Describe the working of refrigeration, air conditioning and cold storage.
CO4: Outline the classification, properties of refrigerants and their effects on the environment.
CO5: Comprehend the applications of Low Temperature Physics.

Unit-I: Production of Low Temperature **(9 Hrs.)**

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 Helium, Adiabatic demagnetization, Properties of materials at low temperatures.

Unit-II: Principles of Refrigeration **(9 Hrs.)**

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

Unit-III: Components of Refrigerator **(9 Hrs.)**

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 and condensers and their functional aspects, defrosting in a refrigerator, frost free refrigerators, Refrigerant leakage and detection.

Unit-IV: Air-Conditioning and Cold storage techniques **(9 Hrs.)**

Air Conditioning basics, working of air condition machines, Air Conditioning Split Systems, superheat and sub cooling, summer air conditioning systems, winter air conditioning systems, all year air conditioning systems, cold storage techniques, working principle-types: Refrigerated Containers, Blast Freezers and chillers, problems encountered with cold storage, energy efficiency, product handling and storage.

Unit-V: Applications of Low Temperature **(9 Hrs.)**

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.

Co-Curricular Activities

1. Watching videos on experiments with Liquid nitrogen and strawberry/ banana/ lemon/ onion/ mushroom/ egg etc. in the laboratory.
2. Seminars using PPTs /videos on Ozone-depleting substances (ODS) that damage the ozone layer in the upper atmosphere.
3. Seminars using videos on tools and techniques in Low Temperatures and applications.
4. Technical assignments identifying tools in Refrigerators, Freezers, air conditioning machines and their handling, operational techniques with safety and security.
5. Invited lectures and presentations on related topics by field /industrial experts.

6. Demonstration of the greenhouse effect and the role of greenhouse gases.
   https://edu.rsc.org/experiments/modelling-the-greenhouse-effect/1543.article
   https://sealevel.jpl.nasa.gov/files/archive/activities/ts1hiac1.pdf

Prescribed Textbook

A course in Refrigeration and Air Conditioning by S.C. Arora and S. Domkundwar, Dhanpatrai and sons, Delhi

Reference Books:

1. Heat and Thermodynamics by Brij Lal &N.Subramanyam, S.Chand Publishers.
2. Low-Temperature Physics by Christian E. & Siegfried H., Springer.
3. Thermal Engineering by S. Singh, S.Pati, Ch:18 Introduction to Refrigeration.
4. The Physics Hyper Text Book. Refrigerators.https://physics.info/refrigerators/
5. Refrigeration and Air Conditioning by Manohar Prasad, New age international (P) limited, New Delhi.
6. Performance and design of AC machines, M.G.Say, ELBS Edn.,
7. Handbook of Repair & Maintenance of domestic electronics appliances; BPB Publications
8. Consumer Electronics, S.P.Bali, Pearson
9. Domestic Appliances Servicing, K.P.Anwer, Scholar Institute Publications
10. https://trc.nist.gov/cryogenics/Papers/Review/2017 Low_Temperature_Applications_and_Challenges.pdf
11. https://nptel.ac.in/content/storage2/courses/112105129/pdf/RAC%2 0Lecture%203.pdf
12. Other Web sources suggested by the teacher concerned and the reading material. https://nptel.ac.in

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
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PRACTICAL SYLLABUS

Subject: Physics **Semester: V/VI**
Course Title: Low Temperature Physics & Applications-Practical
Course Code: 20PHP621LT2
No. of Hours: 30 **LTP: 002** **Credits: 2**

Objectives

- To impart experimental skills
- To provide exposure to experiential learning of basic theoretical concepts by performing experiments.

Course Outcomes

CO1: List out, identify and handle various instruments related to low Temperature Physics.
CO2: Describe the operational procedures of various experiments in Low Temperature Physics & Applications.
CO3: Demonstrate experimental skills and determine the respective physical parameters.

List of Experiments (any six experiments)

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. Consider a simple faulty refrigerator and try to troubleshoot the simple problems by understanding its working.
5. Preparation of freeze drying food with Dry ice.
6. Preparation of freeze drying food with liquid nitrogen.
7. Measure the temperatures of Liquid Nitrogen or Liquid Helium using mercury thermometer and observe their physical properties like colour, smell etc. and precautions to be taken for their safe handling.

Reference Books:

1. Experimental techniques in low temperature physics by Guy White,
   PhilipMeeson.
2. Experimental low-temperature physics by A. Kent, Macmillan physical science series.
3. Physics and Chemistry at Low Temperatures by Leonid Khriachtchev. https://www.routledge.com/Physics-and-Chemistry-at-Low-Temperatures
4. /Khriachtchev/p/book/9789814267519
   .Practical Cryogenics .http://research .physics illinois.edu /bezryadin
   /links/ practical%20Cryogenics.pdf
5. Freeze-Drying, 3rd Edition by Peter Haseley, Georg-Wilhelm Oetjen, Wiley (e-Book)
6. Web sources suggested by the teacher concerned.

- **Skills through Hands on experience on any of the following: (15 Hrs.)**

1. Making simple mini refrigerator at home
2. Building water cooler with the materials available at home.
3. Making hand launched liquid nitrogen rockets.

- **Field visits to any of the following:**

Interact with the technicians and learn the construction, working principle and the trouble shooting of the following units.

1. A visit to small ice plant or a cold storage plant and identification of thermostatic or electronic expansion valves, electronic super-heat controller, evaporator, pressure transmitter, sensitive temperature sensor to the electronic regulator and defrosting units.
2. A visit to an Air Conditioner (AC) repair shop and Identification of various units that control temperature, humidity and quality of the air during Air Conditioning.
3. Identification of various Refrigeration equipment, compressor, condenser,expansion valve and evaporator etc.
4. A visit to refrigerator repair shop:
   - leak detection in refrigeration system
   - Refrigerating capacity/Ton of refrigeration (TR)

- identify the refrigerant cylinder by color coding and standing pressure.

5. A visit to the freezer aisle of a supermarket and observe the bags of different frozen fruits.

• Submission of a report on Fieldwork not exceeding 10 pages in the given format to the teacher on any one of the above.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA - 8
(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Physics **Semester: V/VI**
Course Title: Solar Energy & Applications
Course Code: 20PHSEC22SE3
No. of Hours: 45 **LTP 300** **Credits: 3**

Objectives

To enable learners to acquire knowledge on: basic concepts on solar thermal collectors, solar cells, types and modules and solar photovoltaic systems and their applications.

Course Outcomes

CO1: Summarize the basic concepts of solar radiation principles, collecting techniques and its storage.
CO2: Explain the principles and working of solar thermal collectors and applications.
CO3: Describe the fundamental concepts and working of solar cells and applications.
CO4: Outline the types of solar cells, characteristics, fabrication steps and modules.
CO5: Comprehend the knowledge on solar photovoltaic systems and applications.

Unit-I: Basic concepts of Solar Energy **(9 Hrs.)**

Spectral distribution of solar radiation, Solar constant, zenith angle and Air-Mass, direct, diffuse and total radiations. Pyrheliometer-working principle, direct radiation measurement, Pyrometer-working Principle, diffuse radiation measurement, Distinction between the two meters, Solar pond and Importance of storage of solar energy.

Unit-II: Solar Thermal Collectors **(9 Hrs.)**

Principle of conversion of solar radiation into heat, 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 hot water systems, Solar dryers, Solar desalinators, Solar greenhouses.

Unit-III: Fundamentals of Solar Cells (9 Hrs.)

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 (9 Hrs.)

Conversion of Solar energy into electricity - Photovoltaic effect, Solar photovoltaic cell and its working principle, 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 (9 Hrs.)

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. Photovoltaic applications: Battery chargers, domestic lighting, street lighting and water pumping

- **Co-Curricular Activities**
  1. Familiarization of methods related to measurement of direct, diffused and global solar radiation.
  2. Seminars using videos on tools and techniques in thermal and photovoltaic systems, their technical procedures and applications.
  3. Technical assignments identifying components of a solar hot water and solar photovoltaic systems and their handling, operational techniques and maintenance procedures with safety and security.
  4. Invited lectures and presentations on related topics by field /industrial experts.

5. Demonstration of procedures used in the performance, evaluation of solar flat plate collectors, solar photovoltaic cells and modules, measurement of different parameters needed for calculation of efficiency.

Prescribed Textbook

Solar Energy- Fundamentals, design, modelling and applications by G.N. Tiwari, Narosa Publications, 2005.

Reference Books

1. Solar Energy Utilization by G. D. Rai, Khanna Publishers
2. Solar Energy-Principles of thermal energy collection & storage by S.P. Sukhatme, Tata Mc-Graw Hill Publishers, 1999.
3. Science and Technology of Photovoltaics, P. Jayarama Reddy, CRC Press (Taylor & Francis Group), Leiden &BS Publications, Hyderabad, 2009.
4. Solar Photovoltaics- Fundamentals, technologies and applications, Chetan Singh Solanki, PHI Learning Pvt. Ltd.,
5. Web sources suggested by the teacher concerned and the college librarian including reading material.
   (a)https://courses.edx.org/c4x/DelftX/ET.3034TU/asset/solar_energy_v1.1.pdf
   (b)https://www.sku.ac.ir/Datafiles/BookLibrary/45/John%20A.%20Duffie,%20William%2 0A.%20Beckman(auth.)-Solar%20Engineering%20of%20Thermal%20Processes,%20Fourth%20Edition%20(20 13).pdf

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
(Affiliated to Krishna University, Machilipatnam)

PRACTICAL SYLLABUS

Subject: Physics **Semester: V/VI**
Course Title: Solar Energy & Applications-Practical
Course Code: 20PHP722SE2
No. of Hours: 30 **LTP: 002** **Credits: 2**

Objectives

- To impart experimental skills
- To provide exposure to experiential learning of basic theoretical concepts by performing experiments.

Course Outcomes

CO1: List out, identify and handle various instruments related to Solar energy.

CO2: Describe the operational procedures of various experiments in Solar Energy & Applications

CO3: Demonstrate experimental skills and determine the respective physical parameters.

List of Experiments (any six experiments)

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 characteristics.
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.

Reference Books

1. Solar Photo voltaic- Alab training manual, C.S. Solanki et al., Foundation Books Publishers, 2012.
2. Laboratory Manual on Solar thermal experiments, HP Garg, TC Kandpal, Narosa Publishing House 2000.
3. Web sources suggested by the teacher concerned. https://renewablelab.niu.edu/experiments/solarPanel Development of simple solar hot water collector: https://www.youtube.com/watch?v=WP8H5IOTwYU https://www.instructables.com/Solar-Water-Heater-From-Scratch/

- **Skills through Hands on experience: (15 Hrs.)**

1. Study I-V and P-V characteristics for a photovoltaic module (Solar Cell)
2. Determination of MPP (Maximum Power Point) and calculate fill factor.
3. Investigate the effects of tilting angle on a solar panel on an I-V characteristic.
4. Investigate the effect of incidence of different wavelengths
5. Investigate the effect of series and parallel combination of Solar Cells and respective power characteritics.

- **Field visits**

1. A visit to solar thermal and photovoltaic laboratories in universities/research organizations/ nearby industries to observe and understand the techniques and procedures used for evaluation of solar collector, solar cell and module efficiencies.
   - Submission of a report on Fieldwork not exceeding 10 pages in the given format to the teacher on any one of the above.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
(Affiliated to Krishna University)

SYLLABUS

Subject: Physics **Semester: V/VI**
Course Title: Applications of Electricity & Electronics
Course Code: 20PHSEC31AE3
No. of Hours: 45 **LTP: 300** **Credits: 3**

Objectives

- To impart knowledge on passive elements, types of power sources, power supplies, A.C currents, application of electromagnetic induction and their impact in providing solutions to electrical and communications needs.
- To provide experiential learning by performing concept-based experiments.

Course Outcomes

CO1: Identify various components present in Electricity& Electronics Laboratory.
CO2: Discuss the function of each component like resistors, capacitors, inductors, power sources etc. and their utility.
CO3: Demonstrate skills of constructing simple electronic circuits consisting of basic circuit elements.
CO4: Explain need & functionality of various DC & AC Power sources.
CO5: Comprehend the design, applications and practices of various electrical & Electronic devices and also their trouble shooting.

UNIT-I: Introduction to passive and active elements (9 Hrs.)

Passive and Active elements-examples, **Resistor**-Types of Resistors, Color coding - Applications of a Resistor as a heating element in heaters and as a fuse element. **Capacitor**-Types of Capacitors, Color coding, Energy stored in a capacitor, Applications of Capacitor in power supplies, motors(Fans) etc., **Inductor**-Types of Inductors, EMF induced in an Inductor, Applications of Inductor, Application of choke in a fan and in a radio tuning circuit, Series resonance circuit as a Radio tuning circuit.

UNIT-II: Power Sources (Batteries) **(9 Hrs.)**

Types of power sources-DC & AC sources, Different types of batteries, Rechargeable batteries –Lead acid batteries, Ni-MH batteries, Li-ion batteries- Li-PO batteries, Series, Parallel& Series-Parallel configuration of batteries, Constant Voltage source-Constant Current Source-Applications of Current sources & Voltage sources, SMPS used in computers.

UNIT-III: Alternating currents **(9 Hrs.)**

A.C Power source-Generator, Construction and its working principle, Transformers- Construction and its working principle, 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: Power Supplies (Skill Based) **(9 Hrs.)**

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)

UNIT-V: Applications of Electromagnetic Induction **(9 Hrs.)**

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-DC generator-Construction, operating principle and EMF equation, Construction of a simple DC generator, Difference between DC and AC generator.

➢ **Co-Curricular Activities**

1. Seminars using PPTs /videos on identifying various electrical and electronic components &devices and their handling, operational techniques with safety and security.
2. Seminars using videos on tools and techniques in in Electrical & Electronic Appliances in daily life.

3. Seminars using videos on the motor winding and working of different types of motors.
4. Seminars using videos on the troubleshooting and working of domestic appliances such as cell phone chargers, fan, electric iron, heater, inverter, micro oven, washing machine etc.
5. Invited lectures and presentations on related topics by field /industrial experts.

Reference books

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.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
(Affiliated to Krishna University, Machilipatnam)

PRACTICAL SYLLABUS

Subject: Physics **Semester: V/VI**
Course Title: Applications of Electricity & Electronics-Practical
Course Code: 20PHP631AE2
No. of Hours: 30 **LTP: 002** **Credits: 2**

Objectives

- To impart experimental skills
- To provide exposure to experiential learning of basic theoretical concepts by performing experiments.

Course Outcomes

CO 1: List out, identify and handle various instruments related to Electricity & Electronics.

CO 2: Describe the various operational procedures of various experiments in Applications of Electricity & Electronics.

CO 3: Demonstrate experimental skills and determine the respective physical parameters

List of Experiments (any six of the following):

1. Design and Construction of a 5 Volts DC regulated power supply
2. Construction of a Step down Transformer and measurement of its output voltage. And to compare it with the calculated value.
3. Connect two or three resistors or capacitors or inductors and measure the Series, Parallel Combination values using a Multimeter and compare the values with the Calculated values.
4. Use the Digital Multimeter and Analog Multimeter to measure the output voltage of an AC &DC power supply and also the voltage and frequency of a AC signal using CRO.
5. Use the Multimeter to check the functionality of a Diode and Transistor. Also test whether the given transistor is PNP or NPN.
6. Construct a series electric circuit with R, L and C having an AC source and study the frequency response of this circuit. Find the resonance Frequency.
7. Construct a Parallel electric circuit with R, L & C having an AC source and study the frequency response of this circuit .Find the resonant frequency.
8. Test whether a circuit is a Open circuit or Short Circuit by

measuring continuity with a Multimeter and record your readings.

Lab References:

1. Laboratory Manual for Introductory Electronics Experiments by Maheshwari, L.K. Anand, M.M.S., New Age International (P) Ltd.
2. Electricity-Electronics Fundamentals: A Text-lab Manual by Paul B. Zbar,Joseph Sloop, & Joseph G. Sloop , McGraw-Hill Education
3. Laboratory Manual Basic Electrical Engineering by Umesh Agarwal, Notion Press
4. Basic Electrical and Electronics Engineering by S.K. Bhattacharya , Pearson Publishers.
5. Web sources suggested by the teacher concerned.

- **Skills through Hands on experience on any of the following: (15 Hrs.)**

1. Acquainting with the soldering techniques
2. Measure the value of resistance using multimeter
3. Read the resistance values using colour codes
4. Know the functioning of Capacitors in power supplies, motors etc.
5. Know the functioning of inductors and choke in a fan and in a radio tuning circuit, Series resonance circuit as a Radio tuning circuit.
6. Determine the efficiency and various losses of a step-down (ex: 220-12V) transformer.
7. Determine the efficiency and various losses of a step-up (ex: 120-240V) transformer.
8. Checking the output voltage of a battery eliminator using a Multimeter (Trouble shooting).

- **Field visits to any of the following:**

1. A visit to the local Radio, TV or Mobile repair shop to understand the testing and soldering techniques and different electronic components in the devices that we use daily life.

2. Hands on experience with the troubleshooting and working of domestic appliances such as cell phone chargers, fan, electric iron, heater, inverter, micro oven, washing machine etc.

3. A visit to the Physics / Electronics or Instrumentation Labs of nearby local institutions or laboratories in universities, research organizations, private firms, etc. and get additional knowledge by interacting with the technical people working there.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
(Affiliated to Krishna University)
SYLLABUS

Subject: Physics **Semester: V/VI**
Course Title: Electronic Instrumentation
Course Code: 20PHSEC32EI3
No. of Hours: 45 **LTP: 300** **Credits: 3**

Objectives

- To impart knowledge on Analog instruments & Digital Instruments, Cathode Ray Oscilloscope, Digital storage Oscilloscope, Classification of transducers, Display devices and basic operating principles of biomedical instruments.
- To provide experiential learning by performing concept-based experiments.

Course Outcomes

CO1: Identify various facilities required to set up a basic instrumentation Laboratory.
CO2: Summarize the knowledge of various electrical Instruments used in the Laboratory.
CO3: Demonstrate skills of using instruments like CRO, Function Generator, Multimeter etc.
CO4: Explain the principle and operation of different display devices used in the display systems and different transducers.
CO5: Comprehend the applications of various biomedical instruments in daily life like B.P. meter, Pulse oxymeter etc. and know the handling procedures with safety and security.

UNIT-I: Introduction to Instruments **(9 hrs.)**

Types of electronic Instruments- Analog instruments & Digital Instruments, DC Voltmeter and AC Voltmeter, Construction and working of an Analog Multimeter and Digital Multimeter (Block diagram approach),Sensitivity, 3½display and 4½ display Digital multimeters, Basic ideas on Function generator.

UNIT-II: Oscilloscope **(9 hrs.)**

Cathode Ray Oscilloscope-Introduction, Block diagram of basic CRO, Cathode ray tube, Electron gun assembly, Screen for CRT, Time base operation, Vertical deflection system, Horizontal deflection system, Use of CRO for the measurement of voltage (DC and DC), frequency, phase difference, Different types of oscilloscopes and their uses, Digital storage Oscilloscope.

UNIT-III: Transducers **(9 hrs.)**

Classification of transducers, Selection of transducers, Resistive, capacitive & inductive transducers, Resistive and capacitive touch screen transducer used in mobiles, Displacement transducer-LVDT, Piezoelectric transducer, Photo transducer, Digital transducer, Fibre optic sensors

UNIT-IV: Display Instruments **(9 hrs.)**

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 of 2x16 display and 4x16 LCD modules, Applications of LCD modules.

UNIT-V: Biomedical Instruments **(9 Hrs.)**

Basic operating principles and uses of (i) Clinical thermometer (ii) Stethoscope (iii) Sphygmomanometer (iv) ECG machine (v) Radiography (vi) Ophthalmoscope (vii) Ultrasound scanning (viii) Ventilator (ix) Pulse oxymeter (x) Glucometer, Basic ideas of CT scan and MRI scan.

➢ **Co-Curricular Activities**

1. Seminars using PPTs/videos on identifying different measuring instruments and tools and their handling, operational techniques with safety and security.
2. Seminars using videos on tools and techniques in various branches of instrumentation.
3. Invited lectures and presentations on related topics by field /industrial experts.
4. Collection of material/figures/photos related to products of Measuring Instruments, Display Modules and Biomedical Instruments and arrange them in a systematic way in a file.
5. Making your own stethoscope at home.
6. Making seven segment display at home.

Prescribed Text book

1. Electronic Measurements and Instrumentation by Kishor, K Lal, Pearson, New Delhi

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 by Mandeep Singh, PHI Learning.
4. Biomedical Instrumentation and Measurements by Leslie Cromwell ,Prentice Hall India.
5. Electrical and Electronic Measurements by Sahan, A.K., Dhanpat Rai, New Delhi
6. Electronic Instruments and Measurement Techniques by Cooper, W.D. Halfrick, A.B., PHI Learning, New Delhi
7. Web sources suggested by the teacher concerned and the college librarian including reading material.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
(Affiliated to Krishna University, Machilipatnam)

PRACTICAL SYLLABUS

Subject: Physics **Semester: V/VI**
Course Title: Electronic Instrumentation-Practical
Course Code: 20PHP732EI2
No. of Hours: 30 **LTP: 002** **Credits: 2**

Objectives

- To impart experimental skills
- To provide exposure to experiential learning of basic theoretical concepts by performing experiments.

Course Outcomes

CO 1: List out, identify and handle various equipment in Instrumentation Laboratory.
CO 2: Explain the operational principles of various instruments.
CO 3: Demonstrate skills on handling, maintenance & trouble shooting of different instruments used in the Labs.
CO 4: Measure various electrical and electronic quantities.
CO 5: Measure certain physiological parameters like body temperature, B.P. and sugar levels etc using Biomedical Instrumentation.

List of Experiments (any six of the following):

1. Familiarisation of digital multimeter and its usage in the measurements of (i) resistance, (ii) current, (iii) AC & DC voltages and for (i) continuity test (ii) diode test and (iii) transistor test
2. Measure the AC and DC voltages, frequency using a CRO and compare the values measured with other instruments like Digital multimeter.
3. Formation of Sine, Square wave signals on the CRO using Function Generator and measure their frequencies. Compare the measured values with actual values.
4. Measurement of Phase angle using CRO
5. Display the numbers from 0 to 9 on a single Seven Segment Display module by applying voltages.
6. Display the letters **a** to **h** on a single Seven Segment Display module by applying voltages.

7. Measurement of body temperature using a digital thermometer and list out the error and corrections.
8. Measurement of Blood Pressure of a person using a B.P. meter and record your values and analyze them.
9. Measure the pulse rate of different people and understand the working of the Digital Pulse oxymeter.

Lab References:

1. Electronic Measurement and Instrumentation by J.P. Navani. ,S Chand & Co Ltd
2. Principles of Electronic Instrumentation by A De Sa, Elsevier Science Publ.
3. Electronic Measurements and Instrumentation by S.P.Bihari, YogitaKumari, Dr. Vinay Kakka, Vayu Education of India.
4. Laboratory Manual For Introductory Electronics Experiments by Maheshwari, New Age International (P) Ltd., Publishers.
5. Electricity-Electronics Fundamentals: A Text-lab Manual by Paul B. Zbar ,Joseph Sloop, & Joseph G. Sloop, McGraw Hill Education.
6. Web sources suggested by the teacher concerned.

- **Skills through Hands on experience (15 Hrs.)**

  In consultation with technician, learn the techniques/skills of operation, maintenance and utility of various electrical and electronic instruments both in the Laboratory as well as in daily life.

- **Field Visits**

  1. A visit a local electrical and electronics shop or small firm to familiarize with the various electrical and electronic instruments available in the market and also to understand their functionality, principle of operation and applications as well as the troubleshooting of these instruments.
  2. A visit to a diagnostic centre and observe the ECG machine and the ECG pattern.
  3. A visit to a diagnostic centre and observe the CT scan and MRI scan.
  4. A visit to a mobile smart phone repair shop and observe the different components on the PCB(Motherboard), different

ICs (chips) used in the motherboard and troubleshooting of touch screen in smart phones.

5. A visit to Instrumentation Laboratories of local Universities or Industries like Cement, Chemical or Sugar Plants etc. or any nearby research organizations, private firms, etc.

- Submission of a report on Fieldwork not exceeding 10 pages in the given format to the teacher on any one of the above.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA - 8
(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Physics **Semester: V/VI**
Course Title: Analog & Digital Electronics
Course Code: 20PHSEC41AD3
No. of Hours: 45 Hrs. **LTP 300** **Credits: 3**

Objectives

To enable learners to acquire knowledge on: Working principles of Operational Amplifiers and their applications, combinational and sequential circuits and their applications demanded by advances in other technological areas.

Course Outcomes

CO1: Summarize the basics of operational amplifiers (IC 741), its parameters and its practical applications in electronic circuits.
CO2: Describe the internal architecture IC 555 Timer and its application as astable and monostable multivibrator.
CO3: Compile simple logic operations and code conversions using combinational logic circuits.
CO4: Outline the working of sequential logic circuits and conversion of Flip flops.
CO5: Analyze the concept of registers & Counters.

UNIT-I: Operational Amplifiers **(9 Hrs.)**

Characteristics of ideal and practical Op-Amp (IC 741), its parameters, Offset voltages and off set currents, CMRR, slew rate, concept of virtual ground.

Basic differential amplifier, Op-Amp supply voltage, IC pin diagram of IC 741, internal blocks of Op-Amp, differential and common mode gain.

UNIT-II: Applications of Operational Amplifiers **(9 Hrs.)**

Applications of Op-Amp: Op-Amp as voltage amplifier, Inverting amplifier, Non-inverting amplifier, Voltage follower. IC 555 Timer, its pin diagram, internal architecture, application as astable and monostable

multivibrator Summing amplifier, difference amplifier, comparator, integrator, differentiator.

UNIT-III: Combinational Digital Circuits (9 Hrs.)

Multiplexers (4:1), De-multiplexers (1:4), encoders (8:3), decoders (3:8), Code converters: Design of code converter, BCD to seven segment, Binary/BCD to gray, Gray- to- Binary/BCD, magnitude comparator.

UNIT-IV: Digital Electronics: Sequential logic Circuits (9 Hrs.)

RS latch, Flip-flops, RS Flip-flops, Clocked SR Flip-flops, JK Flip-flops D, T Flip-flops, Master-Slave JK Flip-flops, and Conversion of Flip flops, Applications of sequential circuits

UNIT-V: Shift registers & Counters: (9 Hrs.)

Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).
Ring Counter, Decade Counter, Asynchronous counters, Synchronous Counter.

➢ **Co-Curricular Activities**

1. Seminars using PPTs/ videos on identifying analog and digital instruments and their handling, operational techniques with safety and security.
2. Seminars on applications of analog and digital instruments in other technological areas.
3. Invited lectures and presentations on related topics by field /industrial experts.

Prescribed Book

1. A text book of Applied Electronics by R.S.Sedha
2. Fundamentals of digital circuits by A. Anand Kumar
3. Basics of Operational Amplifiers by Ramakanth Gayakwad

Reference Books

1. Unified Electronics by J.P.Agarwal and Amit Agarwal.
2. Op- Amps and Linear Integrated Circuits by Ramakanth A Gayekwad, 4th edition PHI
3. Fundamentals of Digital Circuits by A.AnandKumar.
4. Operations amplifier by SV Subramanyam.
5. Digital Fundamentals by Floyd & Jain
6. Operational Amplifiers and their applications by Dr.Subir Kumar Sarkar
7. Digital fundamentals of Floyd&Jain

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
(Affiliated to Krishna University, Machilipatnam)

PRACTICAL SYLLABUS

Subject: Physics **Semester: V/VI**
Course Title: Analog & Digital Electronics-Practical
Course Code: 20PHP641AD2
No. of Hours: 30 **LTP: 002** **Credits: 2**

Objectives

- To provide fundamental theoretical knowledge to pursue basic topics in analog and digital circuits.
- To provide experiential learning by performing concept based experiments.

Course Outcomes

CO1: List out, identify and handle various Analog and Digital Electronics instruments.
CO2: Describe the operational procedures of various experiments in Analog & Digital Electronics .
CO3: Demonstrate experimental skills and determine the respective physical parameters.

Minimum of 6 experiments to be done and recorded

1) Op-Amp as an inverting and non-inverting amplifier
2) Op-Amp as integrator & differentiator
3) Op-Amp as a summing amplifier & difference amplifier
4) JK flip-flop, SR flip-flop, D flip flop& T flip flop.
5) IC-555 as astable multivibrator.
6) Encoder and Decoder using logic gates.
7) Implementation of 4X1 MUX & 1X4 DEMUX using logic gates.

Reference Book:

1. B.Sc Practical Physics by Harnam Singh and Dr.P.S.Hemne published by S.Chand.

- **Skills through Hands on experience (15 Hrs.)**

1. Design and verify 4 – bit synchronous & Asynchronous counters.
2. Study the operation of i) SISI ii) SIPO iii) PISO iv) PIPO shift registers.

- **Field Visits to any of the following:**

1. A visit a local electrical and electronics shop or small firm to familiarize with the various analog and digital instruments available in the market, understand their functionality, principle of operation and applications as well as the troubleshooting of these instruments.
2. Study the output waveforms of these analog and digital ICs using CRO and a Function Generator.
3. A visit to a mobile smart phone repair shop and observe the different components on the PCB(Motherboard), different ICs (chips) used in the motherboard and trouble shooting of touch screen in smart phones.
4. A visit to Instrumentation Laboratories of local Universities or Industries or any nearby research organizations, private firms, etc. and submit a report about the analog and digital instruments used and their applications.

- Submission of a report on Fieldwork not exceeding 10 pages in the given format to the teacher on any one of the above.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA - 8
(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Physics **Semester: V/ VI**
Course Title: Electrical & Electronic Instrumentation
Course Code: 20PHSEC42EE3
No. of Hours: 45 **LTP 300** **Credits: 3**

Objectives

To enable learners to acquire knowledge on: measuring physical parameters & instrument characteristics, its behaviour for accurate and reliable measurements and applications of electronic instrumentation demanded by advances in other technological areas.

Course Outcomes

CO1: Explain the capabilities and limitations of test instruments and measurement practices in terms of validity and accuracy.
CO2: Summarize measurement principles involved in the determination of basic electrical parameters using multimeters and CRO.
CO3: Outline the functioning of transformers and their applications in electronic circuits and electrical power transfer systems in daily life.
CO4: Explain the characteristics of transducers and their applications.
CO5: Describe the working of Display Devices and their applications.

Unit-I: Introduction to Instruments (9 Hrs.)

Types of electronic Instruments- Analog instruments & Digital Instruments, PMMC Instrument (qualitatively), galvanometer, DC measurement-ammeter, voltmeter, ohm meter, AC measurement, Digital voltmeter, Digital Multimeter: Block diagram, Digital frequency meter (universal counter) and basic ideas on Function generator.

Unit-II: Cathode Ray Oscilloscope (9 Hrs.)

Block Diagram of basic CRO, CRT, Electron gun assembly, Vertical deflection system, Horizontal deflection system, Screen for CRT, time base operation, synchronization, Use of CRO for the measurement of voltage (a.c and d.c), frequency, phase difference, Different types of oscilloscopes and their uses, Digital Storage Oscilloscopes, block diagram and principle of working.

Unit-III: Transformer & Power supply (9 Hrs.)

Introduction to transformers, construction, working, types of transformers, losses and efficiency. Block Diagram of a Power Supply, Qualitative idea of C and L Filters, IC Regulators (78XX and 79XX), idea of switched mode power supply (SMPS) and uninterrupted power supply (UPS).

Unit-IV: Transducers (9 Hrs.)

Classification of transducers, Selection of transducers, Resistive, capacitive & inductive transducers, Resistive and capacitive touch screen transducer used in mobiles, Displacement transducer-LVDT, Piezoelectric transducer, Photo transducer, Digital transducer, Fibre optic sensors.

Unit- :V Display Devices (9 Hrs.)

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 of 2x16 display and 4x16 LCD modules, Applications of LCD modules.

- **Co-Curricular Activities**

1. Seminars using PPTs/ videos on identifying different measuring instruments and tools and their handling, operational techniques with safety and security.
2. Seminars using videos on tools and techniques in various branches of instrumentation.
3. Invited lectures and presentations on related topics by field /industrial experts.
4. Collection of material / figures/ photos related to products of Measuring Instruments, Display Modules and arrange them in a systematic way in a file.

Prescribed Book

Electronic Instrumentation and Measurements: David A. Bell

Reference Books

1. Electronic Instrumentation -H.S Kalsi TMH(2006)
2. Electronic Measurements and Instrumentation- Dr. K. Lal Kishore
3. A course in Electrical & Electronic Measurement & Instrumentation - A.K Sawhney
4. Alan S. Morris, "Measurement and Instrumentation Principles", Elsevier (Butterworth Heinmann-2008).
5. Joseph J Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education (2005)
6. Electronic Measurements and Instrumentation by Kishor, K Lal, Pearson, New Delhi.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
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PRACTICAL SYLLABUS

Subject: Physics **Semester: V/VI**
Course Title: Electrical & Electronic Instrumentation-Practical
Course Code: 20PHP742EE2
No. of Hours: 30 **LTP: 002** **Credits: 2**

Objectives

- To impart experimental skills
- To provide exposure to experiential learning of basic theoretical concepts by performing experiments using electrical and electronic Instruments.

Course Outcomes

CO 1: List out, identify and handle various electrical and electronic instruments.

CO 2: Describe the operational procedures of various experiments in Electrical & Electronic Instrumentation.

CO 3: Demonstrate experimental skills and determine the various physical parameters.

List of Experiments (any six experiments)

1. Measurement of AC and DC voltages, time period and frequency, using CRO.
2. Phase angle using CRO.
3. Design a regulated power supply using IC-7805.
4. Display the numbers from 0 to 9 on a single Seven Segment Display module by Applying voltages.
5. Display the letters a to h on a single Seven Segment Display module by applying voltages.
6. To determine the Characteristics of LVDT.
7. To study the Characteristics of LDR, Photodiode, and Phototransistor under Variable illumination.

Reference Books:

1. David A. Bell, Electronic Instrumentation & Measurements, Prentice Hall (2013)
2. Electronic Measurement and Instrumentation by J.P. Navani. ,S Chand & Co Ltd
3. Principles of Electronic Instrumentation by A De Sa, Elsevier Science Publ.
4. Electronic Measurements and Instrumentation by S.P.Bihari, YogitaKumari, Dr. Vinay Kakka, Vayu Education of India.
5. Laboratory Manual For Introductory Electronics Experiments by Maheshwari, New Age International (P) Ltd., Publishers.
6. Electricity-Electronics Fundamentals: A Text-lab Manual by Paul B. Zbar ,Joseph Sloop, & Joseph G. Sloop, McGraw-Hill Education.

- **Skills through Hands on experience (15 Hrs.)**

1. In consultation with technician, learn the techniques/skills of operation, maintenance and utility of various electrical and electronic instruments both in the Laboratory as well as in daily life.
2. Characteristics of one Solid State sensor/ Fiber optic sensor.

- **Field Visits to any of the following:**

1. A visit a local electrical and electronics shop or small firm to familiarize with the various electrical and electronic instruments available in the market and also to understand their functionality, principle of operation and applications as well as the troubleshooting of these instruments.
2. Familiarisation of digital multimeter and its usage in the measurements of (i) resistance (ii) current, (iii) AC & DC voltages and for (i) continuity test (ii) diode test and (iii) transistor test.
3. Formation of Sine, Square wave signals on the CRO using Function Generator and measure their frequencies. Compare the measured values with actual values.
4. A visit to a mobile smart phone repair shop and observe the different components on the PCB(Motherboard), different ICs (chips) used in the motherboard and trouble shooting of touch screen in smart phones.
5. A visit to Instrumentation Laboratories of local Universities or

Industries or any nearby research organizations, private firms, etc. and submit a report about the instruments used and their applications.

- Submission of a report on Fieldwork not exceeding 10 pages in the given format to the teacher on any one of the above.