GOVERNMENT COLLEGE FOR WOMEN (A)

GUNTUR

COURSE INFORMATION BOOKLET

2024-2025

DEPARTMENT OF PHYSICS

CONTENTS

Vision and Mission of the Department

Vision

To empower women students with scientific knowledge and technological skills in Physics and Electronics, fostering a culture of curiosity, critical thinking and innovation that contributes to societal development and sustainable progress.

The department aims to inspire future women scientists, researchers, and professionals who will lead advancements in scientific research and applied electronics.

Mission

- To provide a comprehensive education in Physics and Electronics that emphasizes both theoretical knowledge and practical skills, preparing students for advanced studies, research, and industry careers.
- To foster a learning environment that encourages critical thinking, problem-solving, and innovation through hands-on experiments, projects, and research opportunities.
- To promote interdisciplinary learning and collaboration, equipping students with the ability to apply Physics and Electronics principles to real-world problems, including sustainable energy and communication technologies.
- To create opportunities for students to engage with current trends and advancements in Physics and Electronics, ensuring they remain competitive in the rapidly evolving technological landscape.
- To nurture leadership, teamwork, and ethical practices in students through Live projects, empowering them to contribute meaningfully to their communities and the broader scientific community.

Objectives for a B.Sc. Physics programme:

- To understand the concepts and significance of the various physical phenomena.
- To carry out experiments to understand the laws and concepts of Physics.
- To apply the theories learnt and the skills acquired to solve real time problems.
- To acquire a wide range of problem solving skills, both analytical and computational and to apply them.

Program Specific outcomes of B.Sc. Physics

PSO	Upon the successful completion of B.Sc., degree with Physics as one of the subject, the students will be able to
PSO1	Use the phenomenon of physics and components of electronics to design models which can help to become a small scale entrepreneur.
PSO2	Demonstrate knowledge on the mechanism and principles behind advanced electrical appliances
PSO3	Design innovative daily life appliances using principles of Physics

List of Programmes offered by the Department

S.No.	Title of the programme
1	B.Sc. Honours (Physics) Major
3	B.Sc. Mathematics, Physics, Computer Science
4	B.Sc. Mathematics, Physics, Electronics
5	B.Sc. Mathematics, Electronics, Computer Science

B.Sc. Physics course structure (Single major system)

Year	Semester	Course	Title of the Course	Course code
I	I	1	Essentials and Applications of Mathematical, Physical and Chemical Sciences	1PS-CM-01
		2	Advances in Mathematical, Physical and Chemical Sciences	1PS-CM-02
	II	3	Mechanics and Properties of Matter	2PHY - 03
			Mechanics and Properties of Matter Practical Course	
		4	Waves and Oscillations	2PHY - 04
			Waves and Oscillations Practical Course	
Community Service Project				
II	III	5	Optics	2PHY - 05
			Optics Practical Course	
		6	Heat and Thermodynamics	2PHY - 06
			Heat and Thermodynamics Practical Course	
		7	Electronic Devices and Circuits	2PHY - 07
			Electronic Devices and Circuits Practical Course	
		8	Analog and Digital Electronics	2PHY - 08
			Analog and Digital Electronics Practical course	
	IV	9	Electricity and Magnetism	2PHY - 09
			Electricity and Magnetism Practical Course	
		10	Modern Physics	2PHY - 10
			Modern Physics Practical Course	
		11	Introduction to Nuclear and Particle Physics	2PHY - 11
			Introduction to Nuclear and Particle Physics Practical Course	
Short term internship				

B.Sc. Physics course structure (Three major system)

Year	Semester	Title of the Course	Course Code
III	V	Low temperature Physics & Refrigeration	(PHY302-6B)
		Low temperature Physics & Refrigeration Lab – VI	
	V	Solar Energy and its applications	(PHY302-7B)
		Solar Energy and its applications Lab -VII	
	VI	Semester end internship	

Electronics 3 major system course structure

Year	Semester	Title of the course	Course code
III	V	Industrial Electronics	ELE 309-6A
		Industrial Electronics Lab	
		Electronic Instrumentation	ELE 309-7A
		Electronic Instrumentation Lab	
	VI	Semester end internship	

List of Minors offered by the Department

Year	Semester	Minor Subject	Title of the Course	Course Code
I	II	Physics	Industrial Mechanics	MNR2INDPHY-01
			Industrial Mechanics Practical Course	
		Electronics	Fundamentals of Electricity and Electronics	MNR2ELE-01
			Fundamentals of Electricity and Electronics Practical Course	
II	III	Physics	Industrial Nano Physics	
			Industrial Nano Physics Practical Course	
		Electronics	Semiconductor devices and Materials	MNR3ELE-02
			Semiconductor devices and Materials Practical Course	
	IV	Physics	Thermodynamics	
			Thermodynamics Practical Course	
			Material science	
			Material science Practical Course	
		Electronics	Electrical and electronic instrumentation	MNR4ELE-03
			Electrical and electronic instrumentation Practical Course	
			Microprocessor system	MNR4ELE-04
			Microprocessor system Practical Course	

Physics Course wise Syllabus with Outcomes

SEMESTER – I

PAPER– I

Course title: Essentials and Applications of Mathematical, Physical and Chemical Sciences

Course code: 1PS-CM-01

SYLLABUS

CO 2: 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

CO 4: 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.

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 IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY:

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

Recommended books:

1. University Physics with Modern Physics by Hugh D. Young and Roger A. Freedman
2. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker
3. Physics for Scientists and Engineers with Modern Physics" by Raymond A. Serway and John W. Jewett Jr.
4. Physics for Technology and Engineering" by John Bird

SEMESTER – I

PAPER– II

Course title: Advances in Mathematical, Physical and Chemical Sciences

Course code: 1PS-CM-02

SYLLABUS

Course Outcomes:

CO 2: To explain the basic principles and concepts underlying a broad range of fundamental of physics and to connect their knowledge of physics to everyday situations.

CO 5: 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.

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 the Bio-Physics
Recent advances in the Medical-Physics - Shape Memory Materials.

UNIT IV: Advanced applications of mathematics, physics & chemistry

Mathematical Modeling applications in Physics and Chemistry
Application of Renewable energy: Grid Integration and Smart Grids,
Application of nanotechnology: Nano-medicine,
Application of Bio-Physics: Biophysical Imaging, Biomechanics, Neurophysics,
Application of Medical physics: Radiation Therapy, Nuclear medicine, Solid waste management, Environmental remediation- Green Technology, Water treatment

Recommended books:

1. "Renewable Energy: Power for a Sustainable Future" by Godfrey Boyle
2. "Energy Storage: A Nontechnical Guide" by Richard Baxter
3. "Nanotechnology: Principles and Applications" by Sulabha K. Kulkarni and Raghvendra A.Bohara
4. "Biophysics: An Introduction" by Rodney Cotterill
5. "Medical Physics: Imaging" by James G. Webster
6. "Shape Memory Alloys: Properties and Applications" by Dimitris C. Lagoudas

SEMESTER – II
CORE – III
Course title: Mechanics and Properties of Matter
Course code: 2PHY-03

Course Outcomes:

- Able to define , memorize, understand and explore the principles of Mechanics and Properties of Matter
- Able to apply, demonstrate , analyze and differentiate the concepts of the Mechanics and Properties of Matter
- Able to evaluate, create and formulate about the Mechanics and Properties of Matter

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, scatteringcross-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 -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 of a particle under central force - Derivation of Kepler's laws. Motion of satellites- **Basic idea of Global Positioning System (GPS), weightlessness, Physiological effects of astronauts**

UNIT-V: Special theory of relativity

Introduction to relativity, Frames of reference, Galilean relativity-Absolute frames. Michelson-Morley experiment - the negative result - Postulates of special theory of relativity-Lorentz transformation, time dilation, length contraction, **Variation of mass with velocity,** 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

Mechanics and properties of matter practical course: 2PHY-03P

9. Viscosity of liquid by the flow method (Poiseuille's method)
10. Young's modulus of the material of a bar (scale) by uniform bending
11. Young's modulus of the material a bar (scale) by non- uniform bending
12. Surface tension of a liquid by capillary rise method
13. Determination of radius of capillary tube by Hg thread method
14. Viscosity of liquid by Searle's viscometer method
15. Bifilar suspension –moment of inertia of a regular rectangular body.
16. Determination of moment of inertia using Fly-wheel
17. Determination of the height of a building using a sextant.
18. Rigidity modulus of material of a wire-dynamic method (torsional pendulum)

SEMESTER – II
CORE – IV
Course title: Waves and Oscillations
Course code: 2PHY-04

Course outcomes:

1. Able to understand, acquire knowledge and hard skills based on the concepts of waves and Oscillations

2. Able to develop critical and creative thinking skills, problem solving skills to empower themselves by learning the concepts of simple, damped, forced oscillations, complex vibrations, vibrating strings and bars, ultrasonics of waves and oscillations.

3. Able to create, formulate, interpret and evaluate the obtained results in practical, project based and environmental applications of waves and oscillations

UNIT-I : Simple Harmonic oscillations (12 Hrs)

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, Doppler effect, beats, combination of two mutually perpendicular simple harmonic vibrations of same frequency and different frequencies. Lissajous figures.

UNIT-II: Damped and forced oscillations (12 hrs)

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, **Power dissipations.**

UNIT-III: Complex vibrations (12hrs)

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

UNIT-IV: Vibrating Strings and Bars (12 hrs)

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. 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 **(iv) bar free at the both ends,** Tuning fork.

UNIT-V: Ultrasonics (12 hrs)

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

Practical Course 2PHY-04P

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 bystatistical 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 anddamping correction of the amplitude.
10. Formation of Lissajous figures using CRO.

SEMESTER – III
CORE – V
Course title: Optics
Course code: 2PHY-05

Course Outcomes:

CO: 1-Recalls the Optics phenomena through different demonstration methods

CO: 2-Learns the principles, experiments related to wave nature of light

CO: 3-Applies and analyze the learned principles in the daily life applications

UNIT-I: Aberrations

Introduction – Types of aberrations-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 – **Interference of light-Coherence-Coherence sources-** 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, Types of diffraction-difference between interference & diffraction- distinction between Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction – Diffraction due to single slit-Fraunhoffer diffraction pattern at N parallel slits (diffraction grating) - Determination of wavelength of light in normal incidence using diffraction grating- Resolving power of 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- Brewster's law- Mauls law-Nicol prism as a 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, Absorption of light -Spontaneous emission, Stimulated emission-Population Inversion- Laser Principle-Einstein Coefficients-Types of Lasers- Ruby laser, He-Ne laser-Applications of lasers.

Holography: Basic Principle of Holography-Gabor Hologram and its limitations, Applications of Holography.

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Reference books:

1. A Text Book of Optics-N Subramanyam, L Brijlal, S. Chand& Co.
2. Unified Physics Vol. II Optics & Thermodynamics – Jai Prakash Nath & Co. Ltd., Meerut
3. Optics, F.A. Jenkins and H.G. White, Mc Graw-Hill
4. Optics, Ajay Ghatak, Tata Mc Graw-Hill.
5. Introduction of Lasers – Avadhanulu, S. Chand & Co.
6. Principles of Optics- BK Mathur, Gopala Printing Press, 1995

Practical Course 2PHY-05P

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

SEMESTER – III
CORE – VI
Course title: Heat and Thermodynamics
Course code: 2PHY-06

Course Outcomes:

- Able to memorize, understand and explore the basic properties and laws of Heat and Thermodynamics.
- Able to develop, empower critical and reflective thinking with the theories and properties studied in Heat & Thermodynamics and to apply them to learn and differentiate the concepts of Thermodynamics, Entropy, Thermodynamic potentials, Maxwell's equations, low temperature physics, quantum theory of radiation.
- Able to create, formulate, interpret and evaluate the obtained results in practical, project based and environmental applications of Heat & Thermodynamics

UNIT-I: Kinetic theory of gases:
Kinetic Theory of gases- Introduction, **Postulates of Kinetic theory, Pressure exerted by the gas**, 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, **First Law of Thermodynamics,** Carnot's engine and its efficiency, Carnot's theorem, Thermodynamic scale of temperature, Second law of thermodynamics, **Third Law of Thermodynamics - Statement,** 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 Vander 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:

Blackbody, Fery's and Weins black body, 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 pyroheliometer, 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
6. Heat and Thermodynamics- MS Yadav, Anmol Publications Pvt. Ltd, 2000
7. University Physics, HD Young, MW Zemansky, FW Sears, Narosa Publishers, New Delhi

Practical Course 2PHY-06P

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.

SEMESTER – III
CORE – VII
Course title: Electronic Devices And Circuits
Course code: 2PHY-07

Course Outcomes:

CO: 1-Recall the fundamental principles behind the formation and characteristics of p-n junction diodes, tunnel diodes, and Zener diodes and analyze and design circuits using these diodes in various configurations and applications.

CO: 2-Comprehend the construction, working principles and characteristics of BJTs and FETs, and apply this knowledge to design and analyze FET-based circuits.

CO: 3-Understand the construction, working principles, and applications of photoelectric devices such as LEDs, IR emitters, photodiodes, phototransistors, and light-dependent resistors (LDRs), applying this knowledge in practical electronic circuit designs.

UNIT I: PN JUNCTION DIODES

Semiconductor materials- Intrinsic and Extrinsic Semiconductor materials- 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, **Tunneling theory based on energy band diagram**- Zener diode – V I characteristics, Applications-**comparison of tunnel diode and zener diode**

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

Bipolar Junction Transistor -Transistor construction, working of PNP and NPN Transistors, **PNP and NPN Transistor Biasing**, 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, different Biasing methods - Voltage-Divider Bias

UNIT-III: FIELD EFFECT TRANSISTORS & POWER ELECTRONIC DEVICES

Field Effect Transistors -Difference between JFET and BJT- **disadvantages of FET over conventional transistor**-Construction and working of JFET- Drain and Transfer Characteristics-**Uses of FET**

MOSFET – Construction of Depletion type MOSFET -and Enhancement Type of MOSFET- FET Voltage Divider Biasing, UJT- Construction- working, V-I characteristics- **Application**s-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 - 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

Practical Course 2PHY-07P

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. Full wave and Bridge rectifier with filters
6. FET input and output characteristics
7. UJT characteristics
8. LDR characteristics

SEMESTER – III
CORE – VIII
Course title: Analog and Digital Electronics
Course code: 2PHY-08

Course Outcomes:

1. Understand and Explain the principles of Analog and digital electronic circuits and their applications in real-world scenarios
2. Demonstrate, Apply and Analyse the principles of Analog and digital electronic circuits using operational amplifiers, logic gates, flip-flops.
3. Develop the skills to design, construct and evaluate the circuits using logic gates, flip-flops and op-amplifiers and empower themselves with the relevant global and local competencies.

UNIT-1 Analog Systems
Operational Amplifier, Block Diagram of Operational Amplifier, Open loop, Inverting[v-s] and Non-Inverting[V-F]
Applications of Operational Amplifier- Differential Amplifier

UNIT-2 Digital Number Systems and codes
Number Systems- Introductions, Decimals, Binary, Octal and Hexadecimal number systems, Conversions, Binary addition, Binary Subtraction using 1's and 2's Complement Methods.
Codes- Binary codes, BCD code, Gray code, ASCII Conversions

UNIT-3 Digital Circuits Boolean Algebra
Logic Gates- OR, AND, NOT Gates, Truth Tables, Universal Gates- NOR, NAND gate, XOR, XNOR Gates construction of logic gates NOR, NAND
Boolean algebra
1. Postulates of Boolean algebra
2. De morgan's law
3. Simplification of Boolean expression using Boolean law

UNIT -4 Logic circuit And Code Converters
Sequential logic circuits : Flip -flops, Basic NAND NOR latches ,clocked SR flip-flop, D flip-flop, J-k flip flop
Code converters: BCD to decimal converter, BCD to Gray code converter, BCD to seven segment decoders

UNIT- 5 Arithmetic circuits
Half adder, full adder-truth tables and circuits, half subtractor & full subtractor
N-bit parallel adder, 4-bit binary adder, 4-bit binary subtractor

Reference Books:
1. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
2. Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition, 2011,
3. Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., TMH
4. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
5. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
6. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)

Practical Course 2PHY-08P

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 Morgans Theorems
9. Construction of Half adder and Full adders-Verification of truth tables
10. Flip flops
11. Multiplexer and De-multiplexer
12. Encoder and Decoders

SEMESTER – IV
CORE – IX
Course title: Electricity and Magnetism
Course code: 2PHY-09

Course Outcomes:

1. Understand the Gauss law and its application to obtain electric field in different cases and formulate the relationship between electric displacement vector, electric polarization, Susceptibility, Permittivity and Dielectric constant.
2. Distinguish between the magnetic effect of electric current and electromagnetic induction and apply the related laws in appropriate circumstances. Understand Biot and Savart's law and Ampere's circuital law to describe and explain the generationof magnetic fields by electrical currents.
3. Develop an understanding on the unification of electric, and magnetic fields and Maxwell's equations governing electromagnetic waves. Analyze the phenomenon of resonance in LCR AC-circuits, sharpness of resonance, Q- factor, Power factor andthe comparative study of series and parallel resonant circuits

UNIT-I Electrostatics and Dielectrics 9hrs

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 9hrs

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 4hrs

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: 5 hrs

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 9hrs

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 9 hrs

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. Murugeshan, Kiruthiga Sivaprasath, 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.Murugeshan, S. Chand & Co.

Practical Course 2PHY-09P

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.

SEMESTER – IV
CORE – X
Course title: Modern Physics
Course code: 2PHY-10

Course Outcomes:

- Students will be able to acquire knowledge to define, understand and explore the principles and the concepts of the Modern Physics like Vector atom model, Quantum no's, atomic structure and theories related to Quantum mechanics, Superconductors.
- Students will be able to demonstrate, analyse, interpret, differentiate, apply and develop the problem solving skills and digital skills related to the theories of the Modern Physics like Raman Effect, De-broglie's wave hypothesis, Heisenberg Uncertainty Principle, Schrodinger wave equations, Energy in potential well, Superconductors.
- Students will be able to relate the concepts with the critical and creative thinking skills, design the experimental setups with the project based learning , develop , justify, summarise , evaluate the concepts and theories of Modern Physics and empower themselves with the relevant global and local competencies with an awareness of cross-cutting issues like Environment and sustainability related to the concepts of Modern Physics regarding atomic physics, wave mechanics , superconductivity.

UNIT-I: Introduction to Atomic Structure and Spectroscopy:

Vector atom model – Stern and Gerlach experiment, Quantum numbers associated with it, Coupling schemes, Spectral terms and spectral notations, Selection rules, Intensity rules Zeeman effect, Experimental arrangement to study Zeeman effect.

UNIT-II: Molecular Structure and Spectroscopy

Molecular rotational and vibrational spectra, electronic energy levels and electronic transitions, Raman effect, Characteristics of Raman effect, Experimental arrangement to study Raman effect, Quantum theory of Raman effect, Applications of Raman effect. Spectroscopic techniques: IR, UV-Visible, and Raman spectroscopy

UNIT-III: Matter waves & Uncertainty Principle:

Matter waves, de Broglie's hypothesis, 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).

UNIT-IV: Quantum Mechanics:

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-V: Superconductivity:

Introduction to Superconductivity, Experimental results-critical temperature, critical magnetic field, Meissner effect, Isotope effect, Type I and Type II superconductors, BCS theory, high Tc super conductors, Applications of superconductors

Reference Books :

1. BSc Physics, Vol.4, Telugu Academy, Hyderabad

2. Atomic Physics by J.B. Rajam; S. Chand & Co.,

3. Modern Physics by R. Murugeshan and Kiruthiga Siva Prasath. S. Chand & Co

Practical Course 2PHY-10P

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.

SEMESTER – IV
CORE – XI
Course title: Introduction to Nuclear and Particle Physics
Course code: 2PHY-11

Course Outcomes:

1. Know about high energy particles and their applications which prepares them for further study and research in Nuclear physics
2. Students can explain important concepts on nucleon-nucleon interaction, such as its Short-range, spin dependence, iso-spin, and tensors.
3. Students can show the potential shapes from nucleon interactions.
4. Students can explain the single particle model, its strengths, and weaknesses
5. Students can explain magic numbers based on this model

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 electrodynamics 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).

Practical Course 2PHY-11P

1. GM counter – Determination of dead time
2. Study of characteristic curve of a G M Counter and estimation of its operating voltage
3. Estimation of efficiency for a gamma source of a G M Counter
4. To verify inverse square law using a G M Counter
5. Production and attenuation of bremsstrahlung
6. Estimation of efficiency for a beta source of a G M Counter
7. Study of Backscattering of beta particles

SEMESTER – V
PAPER– VI
Course title: Low temperature physics & refrigeration
Course code: PHY302-6B

Course outcomes:
CO1: Develop the concepts of producing low temperatures and Classify various types of thermometers using to measure low temperature and explain its advantages & disadvantages.
CO2: Understand, analyse the concepts of refrigeration and their components & using various refrigerents through hands on experience
CO3: Conclude the applications of Low Temperature Physics and refrigeration in different fields

UNIT-I - Production of Low Temperature (10hrs)
Production of low temperatures - Introduction, Freezing mixtures, **Joule- Kelvin effect (Porous plug experiment)**, Adiabatic demagnetization

Regenerative cooling, Different methods of liquefaction of gases, Hampson's and Linde's liquefaction of air. Production of liquid hydrogen and **Helium (Kapitza's method)**, Properties of materials at low temperatures, Superconductivity, Meissner Effect.

UNIT-II - Measurement of Low Temperature (10hrs)
Gas thermometer and its correction and calibration, Secondary thermometers, resistance thermometers, thermocouples, Advantages and drawbacks of each type of thermometer

Vapour pressure thermometers, Magnetic thermometers, Advantages and drawbacks of each type of thermometer

UNIT-III - Principles of Refrigeration (10hrs)
Introduction to Refrigeration-Types of refrigeration- Natural and artificial refrigeration, Stages of refrigeration, and Vapour compression and vapour absorption refrigeration systems, Refrigeration cycle and explanation with a block diagram, Introductory ideas on air-conditioning, Differentiate between vapour compression and vapour absorption systems

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

UNIT-IV - Components of Refrigerator (10hrs)
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, Refrigerant leakage and detection

UNIT-V - Applications of Low Temperature & Refrigeration (10hrs)

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-importance of liquid nitrogen

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, **Multiple effect distillation**.

References

- Heat and Thermodynamics by Brij Lal &N.Subramanyam, S.Chand Publishers.
- Thermal Physics by S C Garg, R M Bansal & C K Ghosh, McGrawHill Education,
- Heat and Thermodynamics by M MZemansky,McGrawHill Education (India).
- Low-Temperature Physics by Christian E. & Siegfried H., Springer.
- Thermal Engineering by S. Singh, S.Pati, Ch:18 Introduction to Refrigeration.
- The Physics Hyper Text Book. Refrigerators.https://physics.info/refrigerators/
- Refrigeration and Air Conditioning by Manohar Prasad, New age international (P) limited, New Delhi
- A course in Refrigeration and Air Conditioning by S.C. Arora and S. Domkundwar, Dhanpatrai and sons, Delhi
- https://trc.nist.gov/cryogenics/Papers/Review/2017-Low_Temperature_Applications_and_Challenges.pdf
- https://nptel.ac.in/content/storage2/courses/112105129/pdf/RAC%20Lecture%203.pdf
- Other Web sources suggested by the teacher concerned and the reading material. https://nptel.ac.in

Practical Course PHY302-6BP

1. Record the Principles and applications of Refrigerators and Freezers.
2. Measure the temperatures below Melting point of Ice using a thermometer available in the Lab.
3. 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.
4. Study the operation of a refrigerator and understand the working of different parts.
5. Study the properties of refrigerants like chlorofluorocarbons-hydro chloro fluoro- carbons and record the lowest temperatures obtained.
6. Consider a simple faulty refrigerator and try to troubleshoot the simple problems by understanding its working.

SEMESTER – V
PAPER– VII
Course title: Solar Energy and its applications
Course code: PHY302-7B

Course outcomes:
CO-1. To enable the students to acquire knowledge to define, understand , and explore the principles and the concepts of the Structure of Sun, Solar collectors, FPC, PV cell, PV systems.
CO-2. To enable the students to demonstrate , analyse , interpret, differentiate, apply and develop the problem solving skills and digital skills related to the theories of the Structure of Sun, Solar collectors, FPC, PV cell, PV systems.
CO-3. To enable the students to relate the concepts, design the experimental setups with the project based learning and to develop, justify, summarise , evaluate and empower themselves with the relevant global and local competencies with an awareness of cross-cutting issues like Environment sustainability related to the concepts of Structure of Sun, Solar collectors, FPC, PV cell, PV systems ,thin films and its applications

UNIT-I
1. Basic Concepts of Solar Energy (10hrs)
Energy- Sources -Spectral distribution of solar radiation, Solar constant, zenith angle and Air-Mass, standard time, local apparent time, direct, diffuse and total radiations Pyrheliometer-working principle, direct radiation measurement, Pyrometer-working Principle.

Unit-II
2. Solar Thermal Collectors(10hrs)
Solar Thermal Collectors-Introduction, Types of Thermal collectors, Flat plate collector – liquid heating type, Evacuated tube collector, solar water heating system, natural and forced circulation, types of Concentrating collectors, Solar cooker (box type), Solar dryers, Solar Desalinator.

Unit–III
3. Fundamentals Of Solar Cells (10hrs)
Semiconductor interface, Types, homo junction, hetero junction and Schottky barrier, advantages and drawbacks, Photovoltaic cell, conversion efficiency, quantum efficiency, series and shunt resistance.

Unit-IV
4. Types of Solar cells And Modules(10hrs)
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
5. Solar Photovoltaic Systems (10hrs)
Energy storage in PV systems, Energy storage modes: Electrochemical storage, Batteries, Primary and secondary, lead acid battery and dry batteries. Solid-state battery, Molten

solvent battery, Mechanical storage –Flywheel, Electrical storage –Super capacitor

References:

1. Solar Energy Utilization by G. D. Rai, Khanna Publishers
2. Solar Energy- Fundamentals, design, modelling and applications
   by G.N. Tiwari, NarosaPublications,2005.
3. Solar Energy-Principles of thermal energy collection & storage
   by S.P. Sukhatme, TataMc-Graw Hill Publishers, 1999.
4. Science and Technology of Photovoltaics, P. Jayarama Reddy, CRC Press(Taylor &Francis Group), Leiden &BS Publications,Hyderabad,2009.
5. Solar Photovoltaics-Fundamentals, technologies and applications, Chetan Singh Solanki, PHIL earning Pvt. Ltd.,

Project Work- 50 Marks

Preparation of projects using Solar Energy

Electronics Course wise Syllabus with Outcomes

SEMESTER – V
PAPER–VIA
Course Title :: Industrial electronics
Code :: ELE309-6A

Course Outcomes:

CO 1: Describe the construction and working principles of rectifiers and filter circuits. Design and implement voltage regulation circuits for various industrial electronic applications, ensuring stable and reliable power supply.
CO 2: Evaluate different types of regulated power supplies and Design and implement SMPS circuits for various industrial electronic applications. Understand the concepts and functions of voltage doublers andtriplers.
CO 3: Understand the basic principles, construction, and operation of SCRs, Familiarize with the principles of heating effects in inductive and dielectric materials, heating in industrial applications

UNITI: Rectifiers and filters (20 hours)

Rectifiers– Half wave, full-wave and bridge rectifiers- Efficiency-Advantages and disadvantages of Half wave and Full Wave Rectifiers, Ripple factor- Regulation– Types of filters- Choke input (inductor) filter- Shunt capacitor filter- L section and π section filters.
2. Voltage Regulators: Transistor Series voltage regulator - Transistor Shunt voltage regulator – Three terminal regulators (78XX and 79XX).

UNIT II: Power Supplies (10 hours)

Block diagram of regulated power supply – A simple regulated transistorized power supply (circuit and working) – Principle and working of switch mode power supply (SMPS).**Difference between RPS and SMPS, Advantages and Disadvantages of SMPS**

UNIT III: Voltage Multipliers (10 hours)

Half wave voltage doubler, Full wave voltage doubler, Voltage Tripler circuit diagram and working mentioning applications of voltage multipliers.

UNIT IV :Controlled rectifiers (10 hours)
SCR Half wave rectifier circuit, working with wave forms, mathematical analysis for resistive load - SCR Full wave rectifier circuit, working with wave forms, mathematical analysis for resistive load – SCR as inverter parallel and series circuits

UNIT V: **Heat effects (10 hours)**
Resistance, inductance and dielectric heating, Principle of operations and its applications

Reference Books:

1.IndustrialElectronics, G.K. Mithal, KhannaPublishers.

2. Electronic Devices and Circuits – G.K.Mithal.

3.Electronic Devices and Circuits-Millman and Halkias- Tata McGrawHill(TMH)

4. Unified Electronics Volume II by J.P Agarwal and AmitAgarwal.

Practical Course ELE309-6AP

1. D.C Power supply and filters.

2.Transistor series regulator

3.Transistor as a shunt regulator

4.Voltage regulator using IC-7805and IC-7905.

5.Voltage doubler using diodes

6.Voltage Tripler using diodes

7.SCR VI characteristics.

8.SCR Series inverter SCR parallel inverter.

SEMESTER – V
PAPER–VIIA
Course Title :: Electronic Instrumentation
Code :: ELE309-7A

Course Outcomes

CO1:Differentiate between various types of electronic instruments, including analog and digital instruments. Gain basic knowledge of function generators
CO2: Understand the basic principles and operation of a CRO and its importance in electronic measurements and construction, and applications of resistive, capacitive, and inductive transducers.
CO 3: Understand the construction, operation, and applications of LED, LCD displays for numerical representation.Understand the basic operating principles and uses ofBiomedical Instruments, including their application in medical diagnostics.

UNIT-I: Introduction to Instruments (10 hrs)

Measurements: 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, 3½ display and 4½ display, Digital multimeters, Basic ideas on Function generator.

UNIT-II: Oscilloscope (10 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 (AC and DC), frequency, phase difference, Different types of oscilloscopes and uses.

UNIT-III: Transducers (10 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, Fiber optic sensors

UNIT-IV: Display Instruments (10 hrs)
Introduction to Display devices, Seven Segment Displays, LED Displays, Construction and operation (Display of numbers), Types of SSDs (Common Anode & Common Cathode type), Limitations of SSDs, Liquid Crystal Displays, Applications of LCD modules.

UNIT-V: Biomedical Instruments (10 hrs)

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

Reference Books:

1.Electronic Instrumentation by H.S.Kalsi , TMH Publishers

2.Electronic Instrument Hand Book by Clyde F. Coombs ,McGrawHill

3.Introduction to Biomedical Instrumentation byMandeep Singh, PHILearning.

4.Biomedical Instrumentation and Measurements by Leslie Cromwell Prentice

Practical Course ELE309-7AP

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. 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. Measurement of body temperature using a digital thermometer and list out the error and corrections.

7. Measurement of Blood Pressure of a person using a B.P. meter And record the values and analyze them.

MINOR PAPERS SYLLABUS

SEMESTER – II
PHYSICS MINOR PAPER
Course Title :: INDUSTRIAL MECHANICS
Code :: MNR2 INDPHY01

Learning outcomes:

After completion of the course student can able to

1. Demonstrate knowledge of safety practices in industrial environments and apply them in industrial settings.
2. Describe and apply fundamental principles of mechanics, including forces, motion, energy, power, Torque and angular momentum in industrial applications.
3. Identify, analyze, and explain the principles of simple machines and their applications.

Unit-I: Instrumentation and Measurement Techniques

Introduction to measurement tools used in industrial physics-Error analysis in measurements-Calibration of instruments in industrial settings-Safety issues in industry-basic physics principles that govern industrial technology-industrial working conditions, **Environmental measures in industries**

Unit-II: Simple Machines

Understanding the principles of simple machines (levers, pulleys, gears, **wedges, inclined planes)**-Applications of simple machines in everyday life-Newton's laws of motion-Forces and their effects on objects

Unit-III: Kinematics and Dynamics

Introduction to motion analysis in industrial systems-Applications of Newton's laws to industrial scenarios-Force analysis in machinery and structures

Unit-IV: Energy and Work in Industrial Contexts

Work and energy considerations in machines and industrial processes-Efficiency calculations in industrial systems-Potential and kinetic energy in the context of industrial equipment

Unit-IV: Rotational Motion in Industrial Systems

Analysis of rotational motion in machinery-Torque and angular momentum in industrial applications-Rotational equilibrium in structures

Practical Course MNR2 INDPHY01P

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)

SEMESTER – II
ELECTRONICS MINOR PAPER
Course Title :: FUNDAMENTALS OF ELECTRICITY AND ELECTRONICS
Code :: MNR 2ELE 01

Course Outcomes:

CO 1: Comprehend and apply advanced concepts of electric charges, Coulomb's Law, electric fields, and electric potentials in analyzing and solving related physics problems
CO2: Grasp the fundamental principles underlying capacitors, including their construction, operational mechanisms, and electrical characteristics.Master the use of various measurement techniques, such as the Carey- Foster bridge andpotentiometer, B.G.
CO3: Analyze the characteristics of junction diodes and their applications in rectifiers, and filter circuits,Zener diodesAnalyze transistor characteristics in CB and CE configurations, utilize h-parameters, and construct basic logic gates

UNIT-I : Electrostatics(12hrs)
Electric charges - Coulomb's law - Electric field - Electric intensity and electric potential - Relation between electric potential and intensity - Electric intensity and potential due to a uniform charged conducting sphere at a point outside, on, and inside the conductor. Electric dipole - Dipole moment - Intensity and potential due to a dipole. Statement and proof of Gauss law

UNIT-II : Capacitors(12hrs)
Definition and unit of capacity - Capacitance of a parallel plate capacitor - Effect of dielectric on capacity - Capacitors in series and parallel - Energy stored in a charged capacitors - Loss of energy on sharing of charges between two capacitors - Force of attraction between plates of charged parallel plate capacitor - Kelvin's attracted disc electrometer - Measurement of potential and dielectric constant. Type of capacitors - Mica capacitor, Electrolytic capacitors,Variable air capacitor - Uses of capacitors

UNIT-III : Electrical Measurements(12hrs)
Carey-Foster bridge - Determination of specific resistance - Potentiometer . Magnetic Effect of Current: Biot-Savart'slaw , Force on a conductor carrying current placed in a magnetic field - Principle, construction and theory of a moving coil ballistic galvanometer

UNIT-IV : Diode circuits and power Supplies(12hrs)
Junction diode characteristics - Half and full wave rectifiers - Expression for efficiency and ripple factor- Bridge rectifier - Filter circuits - Zener Diode - Characteristics - Regulated power supply using Zener diode - Differentiator and integrator using resistor and capacitor.

UNIT-V:Transistor circuits(12hrs)

Characteristics of a transistor in CB, CE modes - Relatively merits Graphical analysis in CE configuration - Transistor as an amplifier - h parameters. Basis logicgates AND, OR, and NOT - Construction of basic logic gates using diodes and transistors.

Text Books :

Electricity and Magnetism - M. Narayanamoorthi and Others, National PublishingCo., Chennai.

Electricity and Magnetism - R. Murugeshan, S. Chand & Co. Ltd., New Delhi,Revised Edition, 2006. Principles of Electronics - V.K. Mehta, S. Chand & Co., 4/e, 2001.

Basic Electronics - B.L. Theraja, S. Chand & Co., 4/e, 2001.

Practical Course MNR 2ELE 01P

1. Characteristics of Pn junction diode
2. Characteristics of Pn Zener diode
3. CE Characteristics of Transistor
4. Logic Gates
5. Potentiometer- emf of a cell
6. Potentiometer-comparision of emfs of two cells
7. Carey foster bridge –specific resistance determination
8. Thevenińs Theorem-verification
9. Norton's Theorem-verification

SEMESTER – III
PHYSICS MINOR PAPER
Course Title :: Industrial Nano Physics

Course Outcomes:

After the completion of the course , the students will be able to

- Remember, Understand and explain the concept of nanomaterial, types of nanomaterials, synthesis, applications of nanomaterials.
- Demonstrate, Apply and Analyse the concept of nanomaterials, classification, synthesis and applications of nanomaterials.
- Estimate and Reflect the properties of nanomaterial, classification of nanomaterials, Synthesise the *bio- nanomaterial* to empower themselves with the relevant global and local competencies with an awareness of cross-cutting issues like Environment and sustainability .

UNIT-1--- Basic Concepts Nano Materials

History and background of nano science technology, Nanometer, Nanoscale, Nano particles, Nano material, Nano science
Relation between nano science and major fields. Properties of nano particles- mechanical, thermal, optical, electrical properties

UNIT-2-Classification Of Nano Materials

Based on dimension-Zero dimension-Quantum dots, 1d- nano wires, 2d- nano films, 3d-bulk powders, Carbon Bucky Ball.
Based on composition-carbon (CNT), organic, inorganic, composite based nanomaterials.

UNIT-3---Synthesis Of Nano Materials

Approaches to Synthesize Nanomaterials: Top-down Approach, Bottom -Up Approach.
Chemical methods-Co-precipitation method, Sol-gel method, CVD
Physical methods- Sputtering, Evaporation

UNIT-4--Bio nano materials and Characterization Methods

Bio nano material -preparation- biological methods-synthesis-- using plant extracts.
Characterization techniques-XRD for mechanical properties

UNIT-5---Applications Of Nano Materials

Industrial applications of nano materials- Thin films for LED and solar cells, nano particle embedded wrinkle resistant cloth, transparent zinc oxide sun screens.

Nano medical applications-nano materials in drug delivery and therapy.

Reference Books:

- An Introduction to Nanoscience and Nanotechnology, G. Ali Mansoori
- A Textbook of Nanoscience and Nanotechnology, T. Pradeep
- A Textbook of Nanoscience and Nanotechnology, B S Murthy.

Project Work: 50Marks

- **Synthesis of Nanomaterial**

SEMESTER – III
ELECTRONICS MINOR PAPER
Course Title :: Semiconductor Devices and Materials
Code :: MNR 3ELE -02

Course Outcomes :

CO 1: Detailed knowledge of energy bands in inorganic and organic semiconductors Understand energy bands in semiconductors and analyze carrier statistics to determine charge carrier distribution and density.

CO2: Understand the principles of metal-semiconductor contacts, differentiate rectifier and non-rectifier types, and explore FET, MESFET, and MOS structures, MOSFET,CCDs including their applications in VLSI

CO3: Analyze the classifications and applications of optoelectronic devices like solar cells and LEDs, with emphasis on nano-electronic applications and multistage amplifiers, including high-frequency BJT and RC-coupled amplifiers.

Unit I: Inorganic and Organic Semiconductor(12 Hours)

Energy bands, carrier transport, mobility, drift, diffusivity, excess carrier, injection and recombination of the excess carriers, carrier statistics; High field effects: velocity saturation, hot carriers and avalanche breakdown.

Unit II: Majority carrier Devices(12 Hours)

MS contacts rectifier and non-rectifier, MIS structures, **JFET Construction,working and Characteristics of JFET, Parameters of JFET,** MESFET

Unit III: MOS structures (12 Hours)

Semiconductor surfaces; The ideal and non-ideal MOS capacitor band diagrams and CVs; Effects of oxide charges, defects and interface states. MOSFET: Structures and Device Characteristics, Short-Channel effects. Charge coupled Devices (CCDs), application to VLSI.

Unit IV: Non volatile Memory Device. Optoelectronic Devices (12 Hours)

solar cell, photo detectors, LEDs, laser diodes. Nano structures and concepts: quantum wells, supper lattice structures, nanorod, quantum dot, CNTs

Unit-V: Multistage Amplifiers(12 Hours)

BJT at high frequencies, frequency response of RC coupled amplifiers and transformer coupled amplifier.

Reference Books :

1. Donald A. Neanmen,SemiconductorPhysics and Devices Basic 24 Principles, 3rd McGrawHil
2. B.G. Streetman and Sanjay Banerjee, Solid State Electronic Devices, 6thEdn.,PrenticeHall, 2006.
3. S. M. Sze and Kwok K. Ng Physics of Semiconductor Devices, Wiley (2013).

4. M. Hussa, A. Dimoulas and A. Molle, 2D Materials for NanoElectronics, CRC press(2016)
5. M.S.Tyagi, Introduction to Semiconductor Materials and Devices, Willey,

Practical Course MNR 3ELE -02P

1. To study the Hall Effect: determine the Hall coefficient, type of semiconductor and carrier concentration in the given semiconductor sample.

2. To study the four probe method: calculate the resistivity and energy band gap of given semiconductor sample.

3. To determine the resistivity of the given semiconductor specimen using Vander Pauw method.

4. To design a MOSFET as switching regulator for given duty cycle and plot the current voltage (I-V) characteristics of MOSFET using Keithley.

5. To design a phase controlled rectifier using SCR and plot the I-V characteristic of SCR using Keithley.

6. To design a relaxation oscillator using UJT and plot the I-V characteristic of UJT using Keithley.

7. I-V characteristics measurement of a p-n diode /LEDs using Keithley - calculate its ideality factor

SEMESTER – IV
PHYSICS MINOR PAPER
Course Title :: Thermodynamics

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, Second law of thermodynamics Entropy: Physical significance, Change in entropy in reversible and irreversible processes; Temperature - Entropy (T-S) diagram and its uses.

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 - Clausius-Clayperon's equation , Specific Heat, Ratio of Specific Heat.

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.

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 Academy, 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
6. Heat and Thermodynamics- MS Yadav, Anmol Publications Pvt. Ltd, 2000
7. University Physics, HD Young, MW Zemansky, FW Sears, Narosa Publishers, New Delhi

Practical course

1. Specific heat of a liquid –Joule's calorimeter
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 behaviour 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

SEMESTER – IV
PHYSICS MINOR PAPER
Course Title :: Material science

Course Outcomes :

1. To understand the arrangement of atoms and the possible arrangements in solid state materials.
2. Clear understanding of XRD techniques, positions of atoms in a unit cell further useful to obtain knowledge on reciprocal lattice for different systems.
3. To estimate the lattice defects in ionic crystals.
4. To classify the materials, and basic knowledge about glass, glass preparation, characteristics of glass formation.
5. Applications of glasses.

UNIT-I: Introduction to Material science crystal structure:

The basis and the crystal structure-,Primitive lattice cell,- Fundamental types of lattices -Two dimensional lattice types ,three dimensional lattice types, Bravius lattices, Miller indices, Packing density SC,BC and FCC, simple crystal structures – NaCl and Cesium chloride.

UNIT-II: Crystal diffraction and reciprocal lattice :

Bragg's law, Experimental diffraction methods – Laue method and powder method Reciprocal lattice to SC lattice, BCC lattice and FCC lattice Properties of reciprocal lattice .

UNIT-III: Crystal defects:

Properties of metallic lattices and simple alloys: The structure of metals-classification of lattice defects. The formation of lattice defects in metals. Lattice defects in ionic crystals and estimation of concentration of defects in ionic crystals.

UNIT-IV: Classification of materials

Classification of materials: Types of materials – Metals, ceramics (glasses),polymers composites and semiconductors.

Glasses: The glass transition- theories for the glass transition, factors that determine the glass transition temperature, glass formation and preparation of glass materials. Applications of glasses : electronic optical and electrochemical applications.

UNIT-V: Applications of glasses:

Applications of glasses: electronic ,optical and electrochemical applications.
Applications of polymers: electronic, optical and electrochemical applications.

Reference Books:

1. Introduction of solid state physics ,C.Kittel,5^{th} edition
2. Solid state physics A.J Dekker
3. Solid state physics H.C Gupta
4. Physics of amorphous materials by S.R Elliott

SEMESTER – IV
ELECTRONICS MINOR PAPER
Course Title :: Electrical and Electronic Instrumentation
Code :: MNR 4ELE-03

Course Outcomes:

CO1: Comprehend and apply principles of accuracy and precision in measurement, convert a galvanometer into an ammeter, voltmeter, and ohmmeter and evaluate their functionality and applications

CO 2: Understand and apply Wheatstone and Kelvin bridges for precise resistance measurement, analyze AC bridge balancing, and describe the block diagram and operation of oscilloscopes, including deflection sensitivity and electrostatic focusing.

CO 3: Differentiate between analog and digital voltmeters, and understand their applications and the operation of function generators and their use in producing various waveforms.Understand the principles and applications of seven-segment displays and LCDs

UNIT-I :DC and AC indicating Instruments(12hours)

Accuracy and precision - Types of errors – PMMC galvanometer, sensitivity, Loading effect - Conversion of Galvanometer into ammeter, Voltmeter and Shunt type ohmmeter– Multimeter, Electro dynamometer -Thermocoupleinstrument –Electrostatic voltmeter – Watt hour meter.

UNIT-II :DC and AC bridges(12hours)

Wheatstone bridge - Kelvin's bridge - Balancing condition for AC bridgeMaxwell's bridge - Schering's bridge - Wein's bridge - Determination of frequency.

UNIT-III :Oscilloscopes(12hours)

Block diagram - Deflection Sensitivity - Electrostatic Deflection – Electrostatic Focusing - CRT Screen - Measurement of Waveform frequency, phase difference and Time intervals – **Types of Oscilloscopes and uses of oscilloscopes**

UNIT-IV :Instrumentation Amplifiers and Signal Analyzers (12hours)

Instrumentation amplifier - Electronic Voltmeter and Multimeter - Digital Voltmeter - Function Generator - Wave Analyzer - Fundamentals of Spectrum Analyzer.

UNIT-V:Transducer and Display Devices(12hours)

Resistance Thermometer - Photoelectric Transducer - Pen Recorder - Audio Tape Recorder - Resistive, capacitive, inductive transducers, piezo electric Transducer , Fiber optic sensors ,Seven Segment Display - LCD.

Reference Books

1. A Course in Electrical and Electronic Measurement and Instrumentation - A.K. Sawhney, DhanpatRai and Sons.
2. Electronic Instrumentation and Measurements - P.B. Zbar, McGraw Hill International.
3. Measurement Systems Application and Design - Ernest O. Doebelin, 4/e, TataMcGraw Hill Publishing
4. Measurement Systems Application and Design - Ernest O. Doebelin, 4/e, TataMcGraw Hill Publishing

Practical course MNR 4ELE-03P

1. Familiarization 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. 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. Measurement of body temperature using a digital thermometer and list out the error and corrections.

SEMESTER – IV
ELECTRONICS MINOR PAPER
Course Title :: Microprocessor System
Code :: MNR 4ELE -04

Course Outcomes:

1.The student can gain good knowledge on microprocessor understand interfacing of 16 bit microprocessor with memory and peripheral chips involving system design.
2.Learn to transfer data efficiently using different sets of instructions .Write and debug programs
for arithmetic operations such as addition, subtraction, largest and smallest numbers in an array and Convert Binary Coded Decimal to ASCII
3. Understand Minimum and Maximum Mode Configurations .Interrupt Priority Management and interface with various I/O devices. To understand RISC based microprocessors , basic architecture of 16 bit and 32 bit Arm Processors.

UNIT I: CPU ARCHITECTURE (12Hrs)

Introduction to Microprocessor, INTEL -8085(P) Architecture, CPU, ALU unit, Register organization, Address, data and control Buses. Pin configuration of 8085, Addressing modes .

UNIT -II: 8085 INSTRUCTION SET (12 Hrs)

Data transfer Instruction, Logical Instructions, Arithmetic Instructions, Branch Instructions,Machine Control instructions.

UNIT -III: ASSEMBLY LANGUAGE PROGRAMMING USING 8085 (12Hrs)

Programmes for Addition, Subtraction, Multiplication, Division, largest and smallest number in an array. BCD toASCII and ASCII to BCD.

UNIT -IV: BASIC 8086 CONFIGURATIONS(12Hrs)

8086 Microprocessor: Architecture, Pin description, Minimum mode and Maximum Mode, Interrupt Priority Management I/O Interfaces: Serial Communication interfaces, Parallel Communication, DMA controller

UNIT -V: ARM PROCESSOR (12Hrs)
Introduction to 16 / 32 bit processors, Arm architecture & organization, Arm based MCUs, Programming model, Instruction set.

TEXTBOOKS:

1. Microprocessor Architecture, Programming and Applications
2. with the 8085 – PenramInternational Publishing, Mumbai.- Ramesh S. Gaonakar
3. Microcomputer Systems the 8086/8088 family – YU-Cheng Liu and Glenn SA Gibson
4. Microcontrollers Architecture Programming, Interfacing and System Design – Raj Kamal.
5. 8086 and 8088 Microprocessor by Tribel and avatar singh

Practical course MNR 4ELE -04P

List of Experiment Programs using Intel 8085 /8086

1. Addition and Subtraction (8 bit and 16-bit)
2. Multiplication and Division (8-bit)
3. To find Largest number in an array.
4. To find Smalest number in an array.
5. BCD to ASCII and ASCII to BCD .
6. Program To Convert Two BCD Numbers In To Hex
7. Program To Convert Hex Number In To BCD Number.
8. Program To Find The Square Root of a given Number.
9. Interfacing Experiments Using 8086 Microprocessor (Demo)
10. Traffic Light Controller , Elevator, 7-Segment Display