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PENUGONDA – 534320. W.G.DIST.A.P
Phone No: 08819-246126 Email : svkp_penugonda@rediffmail.com Website : svkpandkrajucollege.edu.in

I B.Sc., I –SEMESTER COURSE-I SYLLABUS

W.E.F AY 2023-24 Admitted Batch

PAPER TITLE: ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

PAPER CODE: 23MSC11

Hours: 5hrs/week **Credits: 4**

Course Objective:

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

Learning outcomes:

1. Apply critical thinking skills to solve complex problems involving complex numbers,trigonometric ratios, vectors, and statistical measures.
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
3. To explain the basic principles and concepts underlying a broad range of fundamental areas of chemistry and to connect their knowledge of chemistry to daily life.
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.
5. To explore the history and evolution of the Internet and to gain an understanding of network security concepts, including threats, vulnerabilities, and countermeasures.

UNIT I: ESSENTIALS OF MATHEMATICS: 15hrs

Complex Numbers: Introduction of the new symbol i – General form of a complex number – Modulus- Amplitude form and conversions Trigonometric Ratios: Trigonometric Ratios and their relations – Problems on calculation of angles Vectors: Definition of vector addition – Cartesian form – Scalar and vector product and problems Statistical Measures: Mean, Median, Mode of a data and problems

UNIT II: ESSENTIALS OF PHYSICS: 15hrs

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- Behaviour of atomic and nuclear particles- Wave-particle duality, the uncertainty principle- Theories and understanding of universe

UNIT III: ESSENTIALS OF CHEMISTRY: : 15hrs

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

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY: 15hrs

Applications of Mathematics in Physics & Chemistry: Calculus, Differential Equations & Complex Analysis, Application of Physics in Industry and Technology: Electronics and Semiconductor Industry, Robotics and Automation, Automotive and Aerospace Industries, Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies.

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

UNIT V: ESSENTIALS OF COMPUTER SCIENCE: 15 hrs.

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

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

Recommended books:

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

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I B.Sc., I –SEMESTER COURSE-II SYLLABUS

W.E.F AY 2023-24 Admitted batch

PAPER TITLE: ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

PAPER CODE : 23MSC12

Hours: 5 hrs/week Credits: 4

Course Objective:

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

Learning outcomes:

1. Explore the applications of mathematics in various fields of physics and chemistry, to understand how mathematical concepts are used to model and solve real-world problems.
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.
3. Understand the different sources of renewable energy and their generation processes and advances in nanomaterials and their properties, with a focus on quantum dots. To study the emerging field of quantum communication and its potential applications. To gain an understanding of the principles of biophysics in studying biological systems. Explore the properties and applications of shape memory materials.
4. Understand the principles and techniques used in computer-aided drug design and drug delivery systems, to understand the fabrication techniques and working principles of nanosensors. Explore the effects of chemical pollutants on ecosystems and human health.
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.

6 Understand and convert between different number systems, such as binary, octal, decimal, and hexadecimal. Differentiate between analog and digital signals and understand their characteristics. Gain knowledge of different types of transmission media, such as wired (e.g., copper cables, fiber optics) and wireless (e.g., radio waves, microwave, satellite)..

UNIT I: ADVANCES IN BASICS MATHEMATICS 9hrs

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

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

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

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

UNIT II: ADVANCES IN PHYSICS: 9hrs

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

UNIT III: ADVANCES IN CHEMISTRY: 9hrs

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

UNIT IV: Advanced Applications Of Mathematics, Physics & Chemistry: 9hrs

Mathematical Modelling applications in physics and chemistry Application of Renewable energy: Grid Integration and Smart Grids, Application of nanotechnology: Nanomedicine,

Application of biophysics: Biophysical Imaging, Biomechanics, Neurophysics, **Application of medical physics:** Radiation Therapy, Nuclear medicine Solid waste management, Environmental remediation- Green Technology, Water treatment.

UNIT V: Advanced Applications of computer Science: 9hrs

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

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I B. Sc. Physics (MAJOR/MINOR) : Semester-II Course-3

MECHANICS AND PROPERTIES OF MATTER

(w.e.f. 2023-24 admitted batch)

Theory

Credits: 3 **3hrs/week**

COURSE OBJECTIVE:

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

LEARNING OUTCOMES:

1. Students will be able to understand and apply the concepts of scalar and vector fields, calculate the gradient of a scalar field, determine the divergence and curl of a vector field.
2. Students will be able to apply the laws of motion, solve equations of motion for variable mass systems
3. Students will be able to define a rigid body and comprehend rotational kinematic relations, derive equations of motion for rotating bodies, analyze the precession of a top and gyroscope, understand the precession of the equinoxes
4. Students will be able to define central forces and provide examples, understand the characteristics and conservative nature of central forces derive equations of motion under central forces.
5. Students will be able to differentiate between Galilean relativity and the concept of absolute frames, comprehend the postulates of the special theory of relativity, apply Lorentz transformations, understand and solve problems.

UNIT-I VECTOR ANALYSIS - 9hrs

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 - 9hrs

Laws of motion, motion of variable mass system, Equation of motion of a rocket. Conservation of energy and momentum, Collisions in two and three dimensions,

Concept of impact parameter, scattering cross-section, Rutherford scattering-derivation.

Additional Inputs : Multistage Rocket, Work Energy theorem

UNIT-III MECHANICS OF RIGID BODIES AND CONTINUOUS MEDIA - 9hrs

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

UNIT-IV CENTRAL FORCES 9hrs

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

Additional Inputs : Global Positioning System (GPS)

UNIT-V SPECIAL THEORY OF RELATIVITY - 9hrs

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

REFERENCE BOOKS:

1. B.Sc Physics -Telugu Akademy, Hyderabad
2. Mechanics - D.S. Mathur, Sulthan Chand & Co, New Delhi
3. Mechanics - J.C. Upadhyaya, Ramprasad & Co., Agra
4. Properties of Matter - D.S. Mathur, S.Chand & Co, New Delhi ,11th Edn., 2000
5. Physics Vol. I - Resnick-Halliday-Krane ,Wiley, 2001
6. Properties of Matter – Brijlal & Subrmanyam, S. Chand &Co. 1982
7. Dynamics of Particles and Rigid bodies– Anil Rao, Cambridge Univ Press, 2006
8. Mechanics-EM Purcell, Mc Graw Hill
9. University Physics-FW Sears, MW Zemansky & HD Young, Narosa Publications, Delhi
10. College Physics-I. T. Bhima sankaram and G. Prasad. Himalaya Publishing House.
11. Mechanics, S. G. Venkata chalapathy, Margham Publication, 2003.

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I B.Sc. – PHYSICS –SEMESTER-2, COURSE –3 (MAJOR/MINOR)
MECHANICS AND PROPERTIES OF MATTER (23PHY21)
w.e.f. 2023-24 admitted batch

Time: 3 Hours **Max.Marks: 70**

Answer any FIVE questions from Section A and B choosing atleast Two questions from each section.
Each Question carries 10 marks. **5x10=50Marks**

SECTION-A

1. State and Prove Gauss divergence theorem.
2. State and Prove Stokes theorem.
3. Derive the equation for motion of a rocket.
4. Derive an expression for Rutherford's scattering cross section.
5. Explain and obtain the expression for processional velocity of a symmetric top.

SECTION-B

6. Derive the relation among Y, η and K.
7. Define central force. Show that central force is conservative force.
8. Derive kepler's first law of planetary motion.
9. Describe Michelson and Morley experiment with a neat sketch.
10. Derive Lorentz transformation equations.

SECTION-C

Answer any FIVE Questions. **5x4=20 Marks**

11. Explain the physical significance of curl.
12. Define impact parameter and scattering cross section.
13. Write a short note on precession of the equinoxes.
14. State and explain Kepler's Third law.
15. Write a short note on length contraction.
16. Prove that div (curl **A**) = 0.
17. An empty rocket weighs 6000 kg and contains 44000 kg of fuel. If the exhaust velocity of gases is 1 km/s. Find the maximum velocity attained by the rocket.
18. If the earth be one-half of its present distance from the Sun, What will be the number of days in a year?

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I B. Sc. Physics (MAJOR) : Semester-II Course-4
(w.e.f. 2023-24 admitted batch)
COURSE 4: WAVES AND OSCILLATIONS
Theory
Credits: 3 3hrs/week

COURSE OBJECTIVE:

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

LEARNING OUTCOMES:

The student should be able

1. To describe the basic characteristics of waves such as frequency, wavelength, amplitude, period, and speed.
2. To utilize mathematical relationships related to wave characteristics.
3. To compare particle motion and wave motion in different types of waves.
4. To distinguish between Longitudinal and Transverse waves.
5. To get the knowledge about how to construct and analysis the square waves, saw tooth waves, etc. from Fourier analysis.

UNIT-I Simple Harmonic oscillations - 9hrs

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

Additional Inputs: Frequency of spring taking it's mass into consideration.

UNIT-II Damped and forced oscillations - 9hrs

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

UNIT-III Complex vibrations - 9hrs

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

UNIT-IV

Vibrating Strings and Bars - 9hrs

Transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretched string clamped at ends, overtones and harmonics. Energy transport and transverse impedance. Longitudinal vibrations in bars-wave equation and its general solution. Special cases (i) bar fixed at both ends (ii) bar fixed at the midpoint (iii) bar fixed at one end. Tuning fork.

Additional Inputs : Laws of transverse waves of vibrating string.

UNIT-V Ultrasonics: - 9hrs:

Ultrasonic, properties of ultrasonic waves, production of ultrasonic - by piezoelectric and magneto stricture methods, detection of ultrasonic, determination of wavelength of ultrasonic waves. Applications and uses of ultrasonic waves.

REFERENCE BOOKS:

1. B.Sc. 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.

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I B.Sc. - PHYSICS -SEMESTER-2, COURSE –4 (MAJOR)
WAVES AND OSCILLATIONS (23PHY22)
w.e.f. 2023-24 admitted batch

Time: 3 Hours **Max.Marks: 70**

Answer any FIVE questions from Section A and B choosing atleast Two questions from each section. Each Question carries 10 marks. 5x10=50Marks

SECTION-A

1. Derive the equation of motion of a simple harmonic oscillator and obtain its solution.
2. Discuss the linear combination of two mutually perpendicular simple harmonic vibrations of same frequency.
3. Derive the differential equation for damped harmonic oscillator and its solution and discuss under damped condition.
4. Derive the differential equation for forced harmonic oscillator and its solution.
5. Analyze square wave by using Fourier's theorem.

SECTION-B

6. Analyze saw tooth wave by using Fourier's theorem.
7. Derive the expression for velocity of transverse wave propagation along a stretched string with a neat sketch.
8. Derive an expression for the longitudinal vibrations of a bar fixed at both ends.
9. Explain how to produce ultrasonic waves by using Magnetostriction method
10. 10. Explain how to produce ultrasonic waves by using Piezo electric method.

SECTION-C

Answer any FIVE Questions. **5x4=20 Marks**

11. Write about Lissajous figures.
12. Write a short note on Logarithmic decrement.
13. State Fourier theorem. Derive an expression for Fourier coefficient A_o.
14. Explain Overtones and Harmonics.
15. Write any four applications of Ultrasonics.
16. A spring is stretched by 8 cm by a force of 10 Newton. Find the force constant.
17. The amplitude of a second pendulum falls to half initial value in 150 sec.

Calculate the Q- factor.

18. A steel wire 50 cm long has mass of 5 gm. It is stretched with a tension of 400 N. Find the frequency of the wire in the fundamental mode of vibration.

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SEMESTER-III
COURSE 5: OPTICS (MAJOR / MINOR)

Theory

Credits: 3 3 hrs/week

COURSE OBJECTIVE:

The course on Optics aims to provide students with a fundamental understanding of the behaviour and properties of light and its interaction with matter.

LEARNING OUTCOMES:

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

1. Explain about the different aberrations in lenses and discuss the methods of minimizing them
2. Understand the phenomenon of interference of light and its formation in (i) Lloyd's single mirror due to division of wave front and (ii) Thin films, Newton's rings and Michelson interferometer due to division of amplitude.
3. Distinguish between Fresnel's diffraction and Fraunhoffer diffraction and observe the diffraction patterns in the case of single slit and the diffraction grating and to describe the construction and working of zone plate and make the comparison of zone plate with convex lens
4. Explain the various methods of production of plane, circularly and polarized light and their detection and the concept of optical activity.
5. Comprehend the basic principle of laser, the working of He-Ne laser and Ruby lasers and their applications in different fields. To understand the basic principles of fibre optic communication and explore the field of Holography and Nonlinear optics and their applications.

UNIT-I Aberrations

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

UNIT-II Interference

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

Interferometer.

UNIT-III Diffraction

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

UNIT-IV Polarization

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

UNIT-V Lasers and Holography

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

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REFERENCE BOOKS:

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

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II B.Sc. - PHYSICS -SEMESTER-3, COURSE --5 (MAJOR/MINOR)
OPTICS(23PHY21)

MODEL PAPER
w.e.f. 2023-24 admitted batch

Time: 3 Hours **Max.Marks: 70**

Answer any FIVE questions from Section A and B choosing atleast Two questions from each section.
Each Question carries 10 marks. **5x10=50Marks**

SECTION-A

1. What is Spherical aberration? Explain how to minimize the spherical aberration when two lenses are separated at a distance.
2. What is Chromatic aberration? Derive the condition for achromatism when the two lenses are in contact.
3. Describe the construction of Michelson's Interferometer and explain its working.
4. Describe Newton's rings method for measuring the wavelength of monochromatic light. Give the necessary theory.
5. Describe Fraunhoffer diffraction due to s single slit.

SECTION-B

6. What is Zone plate. Explain the construction and working of Zone plate..
7. Describe the construction and working of Nicol's prism.
8. Give construction and working of Laurent's half shade polarimeter. Explain how to find the specific rotation.
9. Explain the construction and working of Ruby Lasee with nest diagram.
10. Explain the construction and working of Helium-Neon gas Laser with neat diagram.

SECTION-C

Answer any FIVE Questions. **5x4=20 Marks**

11. Explain about astigmatism.
12. Calculate the focal length of dispersive power 0.01 which should be placed in contact with convex lens of focal length 84 cm and dispersive power 0.021 to make achromatic combination.
13. Explain the formation colours in thin films.
14. In Newton's rings experiments the diameter of 10^{th} ring is 0.433 cm. Find the wavelength of incident light, if the radius of curvature is 70 cm.
15. Compare Fresnel and Fraunhoffer classes of diffraction..
16. State and explain Malus law.
17. Calculate thickness of quarter wave plate ,given $\mu_e = 1.533$, $\mu_o = 1.544$ and wavelength =5000AU.
18. Write the applications of Lasers.

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SEMESTER-III
COURSE 6: HEAT AND THERMODYNAMICS (MAJOR)

Theory

Credits: 3 — 3 hrs/week

COURSE OBJECTIVE:

The course on Heat and Thermodynamics aims to provide students with a fundamental understandingof the principles of heat and energy transfer and their applications in various fields

LEARNING OUTCOMES:

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

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

UNIT-I: KINETIC THEORY OF GASES:

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

UNIT-II: THERMODYNAMICS:

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

Additional Topic : Zeroth law and First law of Thermodynamics.

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, Clausius - Clapeyron's equation, 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).

Additional Topic : Applications of substances at low temperatures.

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. B.Sc. 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 Brij Lal, 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, NewDelhi

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II B.Sc. - PHYSICS -SEMESTER-3, COURSE --6 (MAJOR)

HEAT AND THERMODYNAMICS

w.e.f. 2023-24 admitted batch

Time: 3 Hours **Max.Marks: 70**

Answer any FIVE questions from Section A and B choosing atleast Two questions from each section.

Each Question carries 10 marks. **5x10=50Marks**

SECTION-A

1.Derive an expression for Maxwell's l aw of distribution of molecular speeds in a gas.

2.Derive an expression for the Viscosity of a gas on the basis of Kinetic theory of gases.

3.Describe the working of Carnot's engine and derive an expression for its efficiency.

4.Define Entropy. Find the change in entropy in a reversible and irreversible cycle

5.What are thermodynamic potentials? Deduce Maxwells thermodynamic relations from them.

SECTION-B

6.Derive expression for Joule-Kelvin coefficient for ideal gas from thermodynamic relations.

7.Describe Porous plug experiment and write its results.

8.Explain the adiabatic demagnetization method for producing very low temperatures.

9. Derive Planck's radiation law. Derive Wien's law from it.

10.Define Solar Constant. Explain how Solar constant can be determined by Angstrom pyroheliometer.

SECTION-C

Answer any FIVE Questions. **5x4=20 Marks**

11. Explain about Transport Phenomenon.

12.What are Reversible and Irreversible processes? Give examples.

13.Calculate the efficiency of reversible engine working between two temperature. limits 72 ^{0}C and 127^0 C

14. Deduce Clausius - Clapeyron's equation.

15.Calculate the temperature of inversion in the case of H_2 and CO_2 from the following data. Tc for H_2 IS -239.9^{0}C and for CO_2 IS 31 ^{0}C.

16.Write the applications of substances at low temperatures.

17.How do you estimate the temperature of the Sun.?

18. Find the wavelength at which maximum energy is radiated by a black body having a Temperature of 327 ^{0}C. The Wien's Constant is 2.897x10^{-3}Mk.

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SEMESTER-III

COURSE7:ELECTRONICDEVICESANDCIRCUITS (MAJOR)

Theory

Credits:3 3hrs/week

COURSEOBJECTIVE:

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

LEARNINGOUTCOMES:

1. Understand the behavior of P-N junction diodes in forward and reverse bias conditions and analyzetheimpact of junction capacitanceon diode characteristics.
2. Analyze and compare the characteristics and operation of different BJT configurations (CB, CE, andCC)and demonstrate proficiencyin biasingtechniques.
3. Comprehend the operation and characteristics of FETs, including JFETs and MOSFETs, and explaintheworkingprinciples and characteristics ofUJTs.
4. Describe the operation and applications of various photoelectric devices such as LEDs, photo diodes,phototransistors,andLDRs.
5. Understand the operation of rectifiers (half-wave, full-wave, and bridge), analyze the ripple factorand efficiency, and demonstrate knowledge of different filter types and three-terminal voltageregulators

UNIT I: PNJUNCTION DIODES

P-N junction Diode, Formation of depletion region, Forward and Reverse bias Ideal Diode, Diode equation –Reverse saturation current – Tunnel Diode- Construction, working, V-I characteristics and Applications,Zenerdiode–VIcharacteristics, Applications-Voltage Regulator.

UNIT –II:BIPOLARJUNCTIONTRANSISTORANDITSBIASING:(D.C)

Transistor construction, working of PNP and NPN Transistors, ,ConfigurationsofTransistor-CB, CE and CC.InputandOutputCharacteristicsCE-configurations. BJT Transistor Biasing – Need forstabilization,Thermal runaway, Stabilityfactor,Biasingmethods-Voltage-Divider Bias.

UNIT-III: FIELDEFFECTTRANSISTORS&POWERELECTRONICDEVICES–

DifferencebetweenJFETandBJT,ConstructionandworkingofJFET,DrainandTransferCharacteristics,MOSFET-Depletion-type,andEnhancement-TypeMOSFETs..UJT-Construction,working,V-Icharacteristics.SCR–Construction,WorkingandCharacteristics Applications of SCR

UNITIV:PHOTOELECTRICDEVICES:

Light-Emitting Diodes (LEDs) - Construction, working, characteristics and Applications, Photodiode - Construction, working characteristics and Applications, Phototransistors - Construction, working andcharacteristics,Applications, Structureand operationofLDR,

Applications

UNIT-V: POWER SUPPLIES:

Rectifiers: Half wave, Full wave and bridge rectifiers - Efficiency (with derivations), ripple factor- , 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

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II B.Sc. - PHYSICS -SEMESTER-3, COURSE --7(MAJOR)

ELECTRONIC DEVICES AND CIRCUITS.

w.e.f. 2023-24 admitted batch

Time: 3 Hours **Max.Marks: 70**

Answer any FIVE questions from Section A and B choosing atleast Two questions fro
Each Question carries 10 marks. **5x10=50Marks**

SECTION-A

1. Describe the construction and working of a P-N junction diode. Discuss it's V-I characteristics.
2. Describe the construction and working of a Zener diode Discuss it's V-I characteristics..
3. Explain the construction and working of NPN transistor.
4. Draw and explain the input and output characteristics of a transistor in CE configuration.
5. Explain the construction and working of JFET

SECTION-B

6. Discuss the construction, working and characteristics of UJT
7. Explain the principle, construction and characteristics of LED. Write it's applications.
8. Explain the principle, construction and characteristics of Photo transistors.. Write it's applications.
9. Explain the working of Full wave rectifier and calculate its ripple factor and efficiency.
10. Explain the working of Three terminal fixed voltage IC-regulator 78XX _

SECTION-C

Answer any FIVE Questions. **5x4=20 Marks**

11 .Explain about the V-I Characteristics of Tunnel diode.
12. Explain Zener diode as Voltage regulator.
13..Explain the CB, CE and CC configurations a Transistor.
14. For a transistor alpha(α)=0.95 and its emitter current is 1mA . Find the base and collector Currents.
15. What are differences between BJT and JFET.
16. What are the applications of SCR
17... Write the applications of LDR.
18. Explain the working of L-section filter.

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SEMESTER-III
COURSE 8: ANALOG AND DIGITAL ELECTRONICS (MAJOR)

Theory

Credits: 3 3 hrs/week

COURSE OBJECTIVE:

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

LEARNING OUTCOMES:

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

1. Understand Principles and Working of Operational Amplifier
2. Apply their knowledge on OP-Amp in different Applications
3. To understand the number systems, Binary codes and Complements.
4. To understand the Boolean algebra and simplification of Boolean expressions.
5. To analyze logic processes and implement logical operations using combinational logic circuits.
6. To understand the concepts of sequential circuits and to analyze sequential systemsin terms of state machines

UNIT-I: OPERATIONAL AMPLIFIERS

a) Concept of feedback in CE amplifier, negative and positive feedback, advantages and disadvantages of negative feedback, Basic concepts of differential amplifier, Block diagram of op amp and its equivalent circuit, IC Diagram (IC 741), Ideal voltage transfer curve, Open loop Op-Amp configurations - differential, inverting and non-inverting Op-Amps.

b) Voltage Series Feedback Amplifier (Non-Inverting Op amp): Gain and Bandwidth derivations: Voltage Shunt Feedback Amplifier (Inverting Op amp): Gain and Bandwidth derivations

UNIT-II: PRACTICAL OPERATIONAL AMPLIFIER AND APPLICATIONS

a) Characteristics of an Ideal and Practical Operational Amplifier (IC 741), Input offset voltage, Input biascurrent, Input offset current, total output offset voltage, CMRR, slew rate and concept of virtual ground.

b) Applications of Op-Amp: Linear Applications: Voltage Follower, Summing Amplifier, Subtracting Amplifier, Averaging Amplifier, Difference Amplifier, Integrator and Differentiator, Square Wave response of Integrator and Differentiator (Brief explanation only)

UNIT-III: NUMBER SYSTEMS, CODES AND LOGIC GATES

a) Number Systems and Codes: Decimal, Binary, Octal and Hexadecimal number systems, conversions, Binary addition, Binary subtraction using 1's and 2's complement methods, BCD code and Gray code –Conversions

b) Logic Gates: Construction and truth tables of OR, AND, NOT gates, Universal gates – Basic construction and truth tables of NOR & NAND, Realization of logic gates using NAND and NOR, XOR and XNOR Logic gates symbol and their truth tables. De Morgan's Laws, Boolean Laws, Simplification of Boolean Expressions using Boolean Laws

UNIT-IV: ARITHMETIC CIRCUITS & DATA PROCESSING CIRCUITS

a) Half Adder and Full Adder: Explanation of truth tables and Circuits. Half Subtractor and Full Subtractor: Explanation of truth tables and Circuits, 4 - bit binary Adder/Subtractor.

b) Multiplexers - 2 to 1 Multiplexer, 4 to 1 multiplexer, De-multiplexers: 1 to 2 Demultiplexer, 1 to 4 Demultiplexer, Applications of Multiplexers and Demultiplexers Decoders: 1 of 2 decoders, 2 of 4 decoders, Encoders: 4 to 2 Encoder, 8 to 3 Encoder, Applications of decoders and encoders.

UNIT-V: SEQUENTIAL LOGIC CIRCUITS & CODE CONVERTERS

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

b) Code Converters: BCD to Decimal Converter, BCD to Gray Code Converter, BCD to 7 segmentDecoders

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)

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II B.Sc. - PHYSICS -SEMESTER-3, COURSE -8 (MAJOR)

ANALOG AND DIGITAL ELECTRONICS.

w.e.f. 2023-24 admitted batch

Time: 3 Hours **Max.Marks: 70**

Answer any FIVE questions from Section A and B choosing atleast Two questions from each section.

Each Question carries 10 marks. **5x10=50Marks**

SECTION-A

1. Draw the block diagram of Op-Amp and explain the function of each block
2. Describe the configuration of a voltage series feedback amplifier using a non-inverting op-amp.
3. Write characteristics of an ideal Op-amp and explain CMRR and Slew rate.
4. Explain the Operation of Integrator and Differentiator Circuits using Op-Amp
5. Explain Binary subtraction using 1's & 2's complement method with examples.

SECTION-B

6. State and explain Demorgan's laws.
7. Explain the Operation of a Full Adder Circuit with Truth Table.
8. What is Demultiplexer ? Explain 1 to 2 Demultiplexer method.
9. Draw the Circuit Diagram of JK Flip-Flop and explain its Operation with the help of Truth Table.
10. Design and Explain the BCD to 7 segment decoder.

Answer any FIVE Questions. **5x4=20 Marks**

11. Explain the operation of inverting Amplifier using Op-Amp..
12. Calculate CMRR of an Op-amp having differential voltage gain of 1200 and common mode gain of 1.5.
13. Explain the Working of Op-Amp as Voltage Follower.
14. What are Universal gates? Construct AND gate by using NAND gate
15. Subtract 11001 from 10101 using 2's Complement Method.
16. Explain Decoder and Encoder.
17. Explain the operation of Half Subtractor Circuit with Truth Table.
18. Draw the Circuit Diagram of D Flip-Flop and explain its Operation.

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SEMESTER-IV
COURSE 9: ELECTRICITY AND MAGNETISM (MAJOR / MINOR)

Theory

Credits: 3 3 hrs/week

COURSE OBJECTIVE:

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

LEARNING OUTCOMES:

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

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. To learn the methods used to solve problems using loop analysis, Nodal analysis, Thevenin's theorem,Norton's theorem, and the Superposition theorem

3. Distinguish between the magnetic effect of electric current and electromagnetic induction and applythe related laws in appropriate circumstances.

4. Understand Biot and Savart's law and Ampere's circuital law to describe and explain the generationof magnetic fields by electrical currents.

5. Develop an understanding on the unification of electric, and magnetic fields and Maxwell'sequations governing electromagnetic waves.

6. 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

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.
Additional Topic : Deduction of Coulomb's law from Gauss law.

UNIT-II Current electricity

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

UNIT-III Magneto statics

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

Electromagnetic Induction:
Faraday's laws of electromagnetic induction, Lenz's law, Self-induction and Mutual induction, Self- inductance of a long solenoid, Magnetic Energy density. Mutual inductance of a pair of coils. Coefficient of Coupling.
Additional Topic : Eddy currents.

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

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

REFERENCE BOOKS

1. BSc Physics, Vol.3, Telugu Academy, 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.

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II B.Sc. - PHYSICS -SEMESTER-4, COURSE –9 (MAJOR/MINOR)

ELECTRICITY AND MAGNETISM.

w.e.f. 2023-24 admitted batch

Time: 3 Hours **Max.Marks: 70**

Answer any FIVE questions from Section A and B choosing atleast Two questions from each section.

Each Question carries 10 marks. **5x10=50Marks**

SECTION-A

1.State and prove Gauss;s law.

2..Define D, E and P and derive the relation among them.

3..State Kirchoff;s laws and Derive Wheatstine bridge balancing condition.

4.State and prove Thevinin's theorem.

5.State and explain Biot;-Savart's law. Derive an expression for the magnetic field induction at a point on the axis of a current carrying solenoid.

SECTION-B

6.Define and explain Mutual induction. Derive the expression for coefficient of Mutual Induction of two coils.

7. Write the Hertz's experiment for detection of electromagnetic waves.

8. Describe the equation of electromagnetic wave and determine the velocity of propagation of electromagnetic wave in free space.

9. Derive expression for Growth and Decay of currents in L-R Circuit.

10.Describe the LCR AC Series resonant circuit.

SECTION-C

Answer any FIVE Questions. **5x4=20 Marks**

11.Define Dielectric constant and Electric Susceptibility.

12. State and prove Maximum power transfer theorem.

13. Derive expression for magnetic energy density.

14. Write the Maxwell's equations in Integral and Differential forms.

15. Discuss about Quality Factor.

16. A point charge is placed at a point A .The charge 1.5x 10-8 coulombs. What is the radius of the Equipotential surface having a potential of 30 Volts.

17.Calculate the Self inductance of a solenoid of length 1 m and area of cross section 0.01 sq.m With 2000 turns.

18. An LCR Series circuit R=100 ohms, L= 0.5 H and C= 40 uf . Calculate the resonance frequency.

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SEMESTER-IV

COURSE 10: MODERN PHYSICS **(MAJOR / MINOR)**

Theory

Credits: 3 — 3 hrs/week

COURSE OBJECTIVE:

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

LEARNING OUTCOMES:

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

1. Understand the principles of atomic structure and spectroscopy.
2. Understand the principles of molecular structure and spectroscopy
3. Develop critical understanding of concept of Matter waves and Uncertainty principle.
4. Get familiarized with the principles of quantum mechanics and the formulation of Schrodinger wave equation and its applications.
5. Increase the awareness and appreciation of superconductors and their practical applications

UNIT-I: Introduction to Atomic Structure and Spectroscopy:

Bohr's model of the hydrogen atom -Derivation for radius, energy and wave number - Hydrogen spectrum, Vector atom model – Stern and Gerlach experiment, Quantum numbers associated with it, Coupling schemes, Spectral terms and spectral notations, Selection rules. Zeeman effect, Experimental arrangement to study Zeeman effect.
Additional Topic : Short comings Bohr's Theory. Intensity rules.

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).
Additional Topic : Bohr's Complementary principle.

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, London's Equation and Penetration Depth, 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.
4. Concepts of Modern Physics by Arthur Beiser. Tata McGraw-Hill Edition.
5. Nuclear Physics, D.C.Tayal, Himalaya Publishing House.
6. S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publ.Co.)
7. K.K.Chattopadhyay & A.N.Banerjee, Introd.to Nanoscience and Technology(PHI Learning Priv.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 JMurday-Universities Press-IIM

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II B.Sc. - PHYSICS -SEMESTER-4, COURSE –10 (MAJOR/MINOR)

MODERN PHYSICS.

w.e.f. 2023-24 admitted batch

Time: 3 Hours **Max.Marks: 70**

Answer any FIVE questions from Section A and B choosing at least Two questions from each section.

Each Question carries 10 marks. **5x10=50Marks**

SECTION-A

1.Describe the spectral series of Hydrogen atom and explain them on the basis of Bohr's theory.

2. Describe Stern-Gerlach experiment with a neat sketch.

3. Explain the pure rotational energies and spectrum of Diatomic molecule.

4. What is Raman effect? Describe an experimental set up to study Raman effect.

5. Describe Davisson and Germer experiment for the detection of matter waves.

SECTION-B

6. State and explain Heisenberg's uncertainty principle for position and momentum. Extend it to Energy and time.

7. Derive Schrodinger time independent wave equation.

8. Obtain eigen values and eigen functions for a particle enclosed in one dimensional potential box of an infinite height.

9. Explain Type-I and Type-II Super conductors. Distinguish between them..

10. Give the qualitative explanation for BCS theory. Describe how it explain the super conducting State.

SECTION-C

Answer any FIVE Questions. **5x4=20 Marks**

11. Explain L-S and J-J Coupling Schemes.

12. The Wavelength of the first member of Balmer series of hydrogen is 6563 $X10^{-10}$m. Calculate the wavelength of its second member.

13.Write the applications of Raman effect.

14.The existing line in an experiment is 5460A^0 and Stoke line is 5520A^0. Find the wavelength of anti stoke line.

15 .Mention the properties of matter waves.

16.Calculate the Debroglie's wavelength associated with a proton moving with a velocity of 2200 m/sec.

17.Explain physical interpretation of wave function.

18.Write any four applications of super conductors.

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SEMESTER-IV
COURSE 11: INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS
(MAJOR)

Theory

Credits: 3 3 hrs/week

COURSE OBJECTIVE:

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

LEARNING OUTCOMES

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

1. know about high energy particles and their applications which prepares them for further study andresearch in particle physics
2. Students can explain important concepts on nucleon-nucleon interaction, such as its short-range, spindependence, isospin, and tensors.
3. Students can show the potential shapes from nucleon 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.

Additional Topic : Solid state Detector.

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.

Additional Topic: Betatron.

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).

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II B.Sc. - PHYSICS -SEMESTER-4, COURSE –11(MAJOR)

INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS.

w.e.f. 2023-24 admitted batch

Time: 3 Hours **Max.Marks: 70**

Answer any FIVE questions from Section A and B choosing at least Two questions from each section.

Each Question carries 10 marks. **5x10=50Marks**

SECTION-A

1.Write the characteristics Nuclear forces and explain them on the basis of Yukawa's meson theory..

2 Explain Shell model and write it's merits demerits.

3.Discuss in detail about the classification of elementary particles.

4. Discuss in detail about the Types of interactions among elementary particles..

5. What are nuclear reactions.? Write different types of nuclear reactions.

SECTION-B

6. Explain Principle, construction and working of Geiger Muller Counter.

7.Explain Gamow's theory of alpha decay.

8.Discuss in detail the construction, working and applications of Cyclotron.

9. Mention the various Medical applications of Nuclear Particles.

10.Dicuss in detail about a Nuclear reactor and explain how the power generated from it.

SECTION-C

Answer any FIVE Questions. **5x4=20 Marks**

11. Write a short note on Liquid drop model.

12. A nucleus has mass number 125 has the radius 6 fermi . Find the radius of a nucleus having mass number 64.

13 . Write the properties of Leptons and baryons.

14. Write a short note on Scintillation counter..

15. A GM Couter wire collects 10^8 electrons per discharge. When the counting rate Is 500 counts/minute. What will be the average current in the circuit.

16. Explain briefly about the Energy released in Beta decay.

17. Calculate the Cyclotron frequency for electron in a magnetic field 0.2 Tesla. Given charge. Of electron $e=1.6\times10^{-19}$ C and mass of electron $m= 9.11\times10^{-31}$ Kg.

18. Explain briefly about MRI imaging technique. .

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B.Sc. (HONOURS) PHYSICS SINGLE MAJOR

SYLLABUS UNDER CBCS

w.e.f. 2023-24 (Revised in May 2023)

SEMESTER-V

COURSE 12: APPLICATIONS OF ELECTRICITY AND ELECTRONICS

Hours: 45 **Credits: 3** **3 hrs/week**

COURSE OBJECTIVE:

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

LEARNING OUTCOMES:

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

- Identify various components present in Electricity& Electronics Laboratory.
- Acquire a critical knowledge of each component and its utility (like resistors, capacitors, inductors, power sources etc.).
- Demonstrate skills of constructing simple electronic circuits consisting of basic circuit elements.
- Understand the need & Functionality of various DC & AC Power sources.
- Comprehend the design, applications and practices of various electrical & Electronic devices and also their trouble shooting.

Unit-I: Introduction to Passive Elements - 9 hrs

a) **Passive elements**

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

b) **Applications of Passive elements:**

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

Unit-II Power Sources (Batteries)- 9 hrs

a) **Power sources:**

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

b) **Network Theorems for DC circuits**

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

Unit-III Alternating & Direct Currents - 9hrs

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

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

Unit-IV Modulation Circuits - 9 hrs

a) Need for modulation, Types of modulation, Amplitude modulation, modulation index, Waveforms, Power relations, Demodulation, Diode detector

b) **Transmitters and Receivers:**

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

Unit-V Applications of EM Induction & Power Supplies- 9 hrs

a) DC motor – Construction and operating principle, Calculation of power, voltage and current in a DC motor, Design of a simple Motor (for example Fan) with suitable turns of coil

b) Working of a DC regulated power supply, Construction of a 5 volts regulated power supply, Design of a step-down (ex:220-12V) and step-up (ex:120-240V) transformers-Simple Design of FM Radio circuit using LCR series resonance (tuning) circuit, Checking the output voltage of a battery eliminator using a Multimeter. (Trouble shooting), Design of a simple 5 volts DC charger, Power supply for computers (SMPS)

References:

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

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III B. Sc Physics, V Semester, Course-12, (Major-1/ Minor-1)

Applications of Electricity and Electronics

(W.e.f 2023-24 Admitted Batch)

Model Question Paper

Time: 3 Hrs **Max. Marks: 70Marks**

Answer any **Five** questions from section **A** and **B** choosing atleast **Two** questions from each section.

Each question carries 10Marks **5x10=50 Marks**

Section A

1. Explain Capacitor Principle, charging and discharging of Capacitor
2. Explain application of Resistor as a Heating element and as Fuse element
3. Explain types of Batteries Describe construction and working of Lead-Acid batteries
4. State and prove Thevenin's theorem
5. Explain the constructions and working of AC generator.

Section B

6. Explain the construction and working principle of a Transformer
7. Explain Amplitude Modulation and Modulation index, Wave forms
8. Explain about FM Transmitter with a neat diagram.
9. Explain the construction and operating principle of a D.C motor.
10. Explain construction and design of a 5V Regulated Power supply.

Section C

Answer any **FIVE** questions **5x4=20Marks**

11. State and explain Ohm's law and give its limitations.
12. Explain the application of choke in a Fan and in radio tuning circuit
13. Explain types of Power sources –DC and AC Sources
14. Explain SMPS used in computers
15. Explain Step-down and Step-up transformers
16. Write about Frequency modulation
17. Write the equations for calculation of Power, Voltage and current in a DC motor
18. Explain simple design of a FM radio circuit

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III B.Sc. (HONOURS) PHYSICS SINGLE MAJOR

SYLLABUS UNDER CBCS

w.e.f. 2023-24 (Revised in May 2023)

SEMESTER-V

COURSE 13: ELECTRONIC INSTRUMENTATION

Hours: 45 **Credits: 3** **3 hrs/week**

COURSE OBJECTIVE:

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

LEARNING OUTCOMES:

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

- Identify various facilities required to set up a basic Instrumentation Laboratory.
- Acquire a critical knowledge of various Electrical Instruments used in the Laboratory.
- Demonstrate skills of using instruments like CRO, Function Generator, Multimeter etc. through hands on experience.
- Understand the Principle and operation of different display devices used in the display systems and different transducers
- Comprehend the applications of various biomedical instruments in daily life like B.P. meter, ECG, Pulse oximeter etc. and know the handling procedures with safety and security.

UNIT-I Introduction to Instruments – 9 Hrs

a) Basic of measurements:

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

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

UNIT-II Oscilloscope - 9Hrs

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

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

UNIT-III Transducers and Bridges - 9 Hrs

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

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

UNIT-IV ADC and DAC & Display Instruments - 9Hrs

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

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

UNIT-V Amplifiers, Oscillators & Biomedical Instruments - 9 Hrs

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

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

REFERENCE BOOKS:

1. Electronic Instrumentation by H.S.Kalsi ,TMH Publishers
2. Electronic Instrument Hand Book by Clyde F. Coombs ,McGraw Hill
3. Introduction to Biomedical Instrumentation byMandeep Singh, PHI Learning.
4. Electronic Instrumentation – WD Cooper
5. Electrical and Electronic Instrumentation – AK Sawhany
6. A text book in electrical technology by B. L Thereja (S.Chand&Co)
7. *Biomedical Instrumentation* and Measurements by Leslie *Cromwell ,Prentice Hall India.*
8. Electronic Measurements and Instrumentation by Kishor, K Lal, Pearson, New Delhi

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III B. Sc Physics, V Semester, Course-13 (Major-2/ Minor-2)

COURSE 13: ELECTRONIC INSTRUMENTATION (w. e. f 2023-24 Admitted Batch)

Model Question Paper

Time: 3 Hrs **Max. Marks: 70Marks**

Answer any Five questions from section A and B choosing at least Two questions from each section. Each question carries 10Marks. **5x10=50 Marks**

Section-A

1) Explain construction and working of an analog multimeter.
2) Explain about moving iron instrument with a neat sketch.
3) Explain principle and block diagram of cathode ray oscilloscope (CRO).
4) Write about different types of oscilloscopes.
5) Explain about linear variable differential transformer (LVDT).

Section-B

6) Explain about Wheatstone's bridge and derive balancing condition.
7) Explain D/A converter and explain Binary ladder circuit.
8) Describe the construction & working of LED display.
9) Explain RC coupled amplifier with a neat diagram.
10) Write the operating principle and uses of ECG machine.

Section-C

Answer any five questions from the following **5 x 4 = 20 Marks**

11) Define accuracy and sensitivity in instruments.
12) What is 3 ½ digit display meter?
13) Mention the applications of a CRO.
14) Explain Piezoelectric transducer.
15) Write a short note on Wein's bridge.
16) Write the applications of LCD modules.
17) Explain Barkhausen criteria.
18) Write the uses of ultrasound scanning.

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III B.Sc. (HONOURS) PHYSICS SINGLE MAJOR

SYLLABUS UNDER CBCS

w.e.f. 2023-24 (Revised in May 2023)

SEMESTER-V

COURSE 14A: OPTICAL INSTRUMENTS AND OPTOMETRY

Hours: 45 **Credits: 3** **3 hrs/week**

COURSE OBJECTIVE:

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

LEARNING OUTCOMES:

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

- Understand the construction and working principles of various optical instruments usedin daily life.
- Acquire a critical knowledge on the various defects of eye and their correcting methodswith suitable lenses.
- Demonstrate skills of using biological microscope through hands on experience.
- Understand the various techniques used in optometry and computer-based eye testing.
- Comprehend the various applications of microscopes and telescopes.

UNIT-I Optical Microscopes- 9 hrs

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

UNIT-II Telescopes - 9 hrs

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

UNIT-IV Optical Vision - 9 hrs

Introduction to optical Vision, Eye as an optical instrument, Formation of image in the eyeand the camera, Ophthalmic lenses, 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, Principles of Computer based eye testing

Reference Books

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

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III B.Sc. – PHYSICS –SEMESTER-V, COURSE – 14A (MAJOR)

Course 14A: OPLTICAL INSTRUMENTS AND OPTOMETRY (w.e.f. 2025–26 admitted batch)

MODEL PAPER

Time: 3 Hours **Max. Marks: 70**

Answer any FIVE questions from Section-A and Section-B choosing at least Two questions from each section.

Each Question carries 10 marks. **5x10=50Marks**

SECTION-A

1. Explain the construction of Compound microscope and derive the formula for Magnifying power.
2. Explain the construction and working of Travelling microscope.
3. Explain the construction and working of Refracting Telescope.
4. Explain the working principle of Binoculars.
5. Explain various applications of Electron microscopes (TEM, SEM).

SECTION-B

6 . Explain various applications of UV telescope.
7. Explain the defects Myopia and Hypermetropia. Also Explain how these defects are removed by using ophthalmic lenses.
8. Explain different types of contact lenses.
9. What is a Kerato-meter? Explain the working principle of a Kerato-meter.
10. Explain the working principle of simple phoropter and mention its uses.

SECTION-C

Answer any FIVE Questions. **5x4=20 Marks**

11. Write a short note on simple microscope.
12. Write a short note on phase contrast microscope.
13. Explain the applications of Binoculars.
14. Mention the various applications of Solar telescopes.
15. Explain Eye as an optical instrument.
16. Write a short note on Ophthalmic lenses.
17. Explain the working principle of Ophthalmoscope.
18. Explain the principles of computer-based eye testing.

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III B.Sc. (HONOURS) PHYSICS SINGLE MAJOR

SYLLABUS UNDER CBCS
w.e.f. 2023-24 (Revised in May 2023)

SEMESTER-V

COURSE 15A: LOW TEMPERATURE PHYSICS & REFRIGERATION

Hours: 45 **Credits: 3** **3 hrs/week**

COURSE OBJECTIVE:

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

LEARNING OUTCOMES:

Students after successful completion of the course will be able to

- Identify various methods and techniques used to produce low temperatures in the Laboratory.
- Acquire a critical knowledge on refrigeration and air conditioning.
- Demonstrate skills of Refrigerators through hands on experience and learns about refrigeration components and their accessories.
- Understand the classification, properties of refrigerants and their effects on environment.
- Comprehend the applications of Low Temperature Physics and refrigeration.

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 Measurement of Low Temperature- 9 hrs

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

UNIT-III Principles of Refrigeration - 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, Introductory ideas on air- conditioning.
Refrigerants-Introduction, Ideal refrigerant, Properties of refrigerant, Classification of refrigerants, commonly used refrigerants, Eco-friendly refrigerants

UNIT-IV Components of Refrigerator- 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, condensers, and their functional aspects, defrosting in a refrigerator, Refrigerant leakage and detection

UNIT-V Applications of Low Temperature & Refrigeration - 9hrs

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

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

References

1. Heat and Thermodynamics by Brij Lal &N.Subramanyam, S.Chand Publishers.
2. Thermal Physics by S C Garg, R M Bansal & C K Ghosh, McGrawHill Education,India
3. Heat and Thermodynamics by M MZemansky,McGrawHill Education (India).
4. Low-Temperature Physics by Christian E. & Siegfried H., Springer.
5. Thermal Engineering by S. Singh, S.Pati, Ch:18 Introduction to Refrigeration.
6. The Physics Hyper Text Book. Refrigerators.https://physics.info/refrigerators/
7. Refrigeration and Air Conditioning by Manohar Prasad, New age international (P)limited, New Delhi
8. A course in Refrigeration and Air Conditioning by S.C. Arora and S. Domkundwar,Dhanpatrai and sons, Delhi
9. https://trc.nist.gov/cryogenics/Papers/Review/2017-Low Temperature Applications and Challenges.pdf

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III B.Sc. – PHYSICS –SEMESTER-V, COURSE –15A (MAJOR)
COURSE 15A: LOW TEMPERATURE PHYSICS & REFRIGERATION

w.e.f. 2023–24 admitted batch

Time: 3 Hours **Max.Marks: 70**

Answer any FIVE questions from sections A and B choosing at least TWO questions from each section.

Each question carries 10 marks. **5 × 10 = 50M**

SECTION – A

1. Describe the production mechanism involved in the production of liquid Hydrogen.
2. What is adiabatic demagnetization? Give its theory and working.
3. Explain about Constant volume gas thermometer with a neat diagram.
4. Explain the working of Linde's process and write its advantages and drawbacks.
5. Explain about the vapour compression refrigeration system.

SECTION – B

6. Explain about the classification of refrigerants.
7. Explain refrigerator and its working with block diagram.
8. Explain about various types of compressors.
9. Explain the applications of low temperatures in
    1. Preservation of biological materials
    2. Food freezing.
10. Explain the working of water cooler.

SECTION – C

Answer any FIVE questions. **5 × 4 = 20 M**

11. Discuss properties of materials at low temperatures.
12. Explain superconductivity.
13. Explain thermocouple thermometer.
14. Explain the stages of Refrigeration.
15. Write a short note on Eco-friendly refrigerants.
16. Explain about refrigerant leakage.
17. Write a short note on Cryogenic rocket propulsion system.
18. Explain about the role of refrigeration in Desalination of water.