CURRICULUM TRANSACTION STRATEGY (CTS)

DEPARTMENT **: PHYSICS**
SCHOOL **: SCHOOL OF PHYSICAL AND CHEMICAL SCIENCES**
CAMPUS **: SONWAR CAMPUS SRINAGAR, CENTRAL UNIVERSITY OF KASHMIR**
CONCERNED TEACHER**: *MR. RAJA NISAR ALI***
COURSE TITLE**: ELECTRICITY & MAGNETISM *(PHYSICS-II)***
COURSE CODE : ***PHY-CC-103***
SESSION : ***AUGUST, 2015- FEBRUARY, 2016, AUGUST, 2016 - FEBRUARY, 2017 and MAY-AUGUST, 2017***
SEMESTER: ***IST***

Unit	Topic	Method	No. of Lectures
I	Revision of basic vector calculus (Griffith Ist Chapter)	Lecture, discussion	08
	Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry.	do	03
	Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. The Uniqueness Theorem. Potential and Electric Field of a dipole. Force and Torque on a dipole	do	03
	Electrostatic energy of system of charges. Electrostatic energy of a charged sphere.	do	02
	Conductors in an electrostatic Field. Surface charge and force on a conductor.	do	01
	Capacitance of a system of charged conductors e.g. Parallel-plate capacitor, spherical, cylindrical	do	02
	Assignments by the students	Presentation discussion	02

Learning Outcomes

On concluding the unit-I Students shall be able to understand the following points

- Gradient, Divergence, Curl, Gauss divergence Theorem, Stock's theorem, Greens theorem , Line Integral, Surface Integral, Volume Integral
- Electric field:Electric field lines. Electric flux.
- Gauss' Law and its applications.
- Conservative nature of Electrostatic Field. Electrostatic Potential.
- Laplace's and Poisson equations. The Uniqueness Theorem.
- Potential and Electric Field of a dipole. Force and Torque on a dipole
- Electrostatic energy of system of charges with different geometries.
- Surface charge and force on a conductor.

- Capacitance of Parallel-plate capacitor, spherical capacitor, cylindrical capacitor.

- **Activities**
- Provided hand written notes
- Presentation of group of students on respective topics assigned to them.
- *Conducting Continuous internal assessment test First (CIA - I).*
- ***Points for discussion:*** *Electric field lines. Electric flux. Conservative nature of Electrostatic Field. Electrostatic Potential The Uniqueness Theorem, Potential and Electric Field of a dipole. Electrostatic energy of system, Capacitance of Parallel-plate capacitor, spherical capacitor.*

Text Books:

- Introduction to Electrodynamics, D. J. Griffith, 4rd Edn. 1998, Pearson Education.

References:

- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Chaudhary 2012, Tata McGraw.
- Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.

- Feynman Lectures Vol. 2, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.
- Elements of Electromagnetism, M. N. O. Sadiku, 2010, Oxford University Press.
- Electricity and Magnetism, J. H. Fewkes& J. Yarwood. Vol.I, 1991, Oxford Univ. Press.

Unit	Topic	Method	No. of Lectures
II	Dielectric Properties of Matter: Electric Field Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant.	Lecture, discussion	03
	Capacitor filled with dielectric. Displacement vector D. Relations between E, P and D. Gauss' Law in dielectrics.	do	03
	Magnetic Field: Magnetic force between current elements and definition of Magnetic Field B. Biot-Savart's Law and its simple applications: straight wire and circular loop	do	03
	Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole).	do	02
	Ampere's Circuital Law and its application to Solenoid and) Toroid. Properties of B: Curl and divergence.	do	02
	Vector Potential. Magnetic Force on point charge, current carrying wire and between current elements. Torque on a current loop in a uniform Magnetic Field.	do	02
	Assignments by the students	Presentation discussion	02

Learning Outcomes

On concluding the unit-II Students shall be able to understand the following topics

- Electric Field in matter and Dielectric Properties of Matter.
- Polarization, surface and volume Charges. Electrical Susceptibility and Dielectric Constant.
- Capacitor filled with dielectric. Displacement vector D. Relations between E, P and D. Gauss' Law in dielectrics.
- Magnetic force between current elements and definition of Magnetic Field B. Biot-Savart's Law and its simple applications,Magnetic Dipole and its Dipole Moment
- Ampere's Circuital Law and its application to
- Properties of B: curl and divergence. Vector Potential. Magnetic Force between current elements definition of Ampere as unit of current.

Activities

- Provided hand written notes
- Presentation of group of students on respective topics assigned to them.
- *Conducting Continuous internal assessment test second (CIA - II).*
- *Points for discussion: Concept of electric Field in matter,Polarization, surface and volume Charges. Electrical Susceptibility and Dielectric Constant. Magnetic Field B. Biot-Savart's Law and its simple applications, Magnetic Dipole and its Dipole Moment, Magnetic Vector Potential*

Text Books:

- Introduction to Electrodynamics, D. J. Griffith, 4rd Edn. 1998, Pearson Education.

References:

- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Chaudhary 2012, Tata McGraw.
- Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.

- Feynman Lectures Vol. 2, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.
- Elements of Electromagnetism, M. N. O. Sadiku, 2010, Oxford University Press.
- Electricity and Magnetism, J. H. Fewkes& J. Yarwood. Vol.I, 1991, Oxford Univ. Press.

Unit	Topic	Method	No. of Lectures
III	Magnetic Properties of Matter: Magnetization vector (M), Magnetic Intensity (H),	Lecture, discussion	02
	Magnetic Susceptibility and permeability, Relation between B, H and M. Ferro-magnetism, B-H curve and hysteresis.	do	02
	Electromagnetic Induction: Faraday's Law. Lenz's Law. Self Inductance and Mutual Inductance.	do	03
	Reciprocity Theorem. Energy stored in a Magnetic Field,	do	02
	Introduction to Maxwell's Equations. Charge Conservation and Displacement current.	do	02
	Assignments by the students	Presentation discussion	03

Learning Outcomes

On concluding the unit-III Students shall be able to understand the following topics

- Magnetic Properties of Matter
- Ferro-magnetism, B-H curve and hysteresis.
- Electromagnetic Induction: Faraday's Law. Lenz's Law. Self Inductance and Mutual Inductance.
- Maxwell's Equations. Charge Conservation and Displacement current

Activities

- Provided hand written notes
- Presentation and discussion group of students on respective topics assigned to them.
- *Conducting Continuous internal assessment test Third (CIA - III).*

- ***Points for discussion:*** *Magnetic Properties of Matter, Ferro-magnetism, B-H curve and hysteresis. Electromagnetic Induction: Faraday's Law. Lenz's Law. Self Inductance and Mutual Inductance. Maxwell's Equations. Charge Conservation and Displacement current*

Text Books:

- Introduction to Electrodynamics, D. J. Griffith, 4rd Edn. 1998, Pearson Education.

References:

- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Chaudhary 2012, Tata McGraw.
- Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
- Feynman Lectures Vol. 2, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.
- Elements of Electromagnetism, M. N. O. Sadiku, 2010, Oxford University Press.
- *Electricity and Magnetism, J. H. Fewkes& J. Yarwood. Vol.I, 1991, Oxford Univ. Press.*

Unit	Topic	Method	No. of Lectures
IV	Electric Circuits: AC Circuits: Kirchhoff's laws for AC circuits.	Lecture, discussion	03
	Complex Reactance and Impedance.	do	02
	Series LCR Circuit, Resonance, Power Dissipation, Quality Factor, and Band Width. Parallel LCR Circuit.	do	02
	Network theorem: Ideal Constant-voltage and Constant-current Sources.	do	03
	Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem with applications	do	03
	Reciprocity theorem, Maximum Power Transfer theorem. Applications to dc circuits.	do	03
	Assignments by the students	Presentation discussion	02

Learning Outcomes

On concluding the unit-IV Students shall be able to understand the following topics

- *Electric Circuits: AC Circuits: Kirchhoff's laws for AC circuits*
- *Series LCR Circuit, Resonance, Power Dissipation, Quality Factor, and Band Width.*
- *Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem with applications,*
- *Reciprocity theorem, Maximum Power Transfer theorem. Applications to dc circuits.*

Activities

- Provided hand written notes
- Presentation and discussion group of students on respective topics assigned to them.
- *Conducting Continuous internal assessment test Third (CIA – IV- Optional).*

- ***Points for discussion:*** *Electric Circuits: AC Circuits: Kirchhoff's laws for AC circuits,Series LCR Circuit, Resonance, Power Dissipation, Quality Factor, and Band Width. Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem with applications, Reciprocity theorem, Maximum Power Transfer theorem. Applications to dc circuits.*

Text Books:

- Introduction to Electrodynamics, D. J. Griffith, 4rd Edn. 1998, Pearson Education.

References:

- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Chaudhary 2012, Tata McGraw.
- Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
- Feynman Lectures Vol. 2, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.
- Elements of Electromagnetism, M. N. O. Sadiku, 2010, Oxford University Press.
- *Electricity and Magnetism, J. H. Fewkes& J. Yarwood. Vol.I, 1991, Oxford Univ. Press.*

COURSE TITLE**: THERMAL *PHYSICS (PHYSICS-III)***
COURSE CODE : ***PHY-CC-201***
SESSION : ***MARCH - JULY, 2016*** SEMESTER: ***2ND***

Unit	Topic	Method	No. of Lectures
I	Zeroth a of Thermodynamics and concept of temperature, thermodynamic equilibrium First Law of Thermodynamics.	Lecture, discussion	02
	Concept of Work & Heat, transformation of energy, thermodynamic State Functions.	do	03
	First Law of Thermodynamics and its differential form.	do	02
	Internal Energy, different types of thermodynamic processes, Isothermal Process and Adiabatic Process quasistatic Process	do	02
	Applications of First Law: General Relation between C_P and C_V	do	02
	Work Done during Isothermal and Adiabatic Processes	do	02
	Assignments by the students	Presentation discussion	02

Learning Outcomes

On concluding the unit-I Students shall be able to understand the following points

- Explain Zeroth and First Law of Thermodynamics.
- Distinguish between concepts of Temperature Work & Heat.
- Explain State Functions.
- Explain First Law of Thermodynamics and its differential form.
- Define measurement and evaluation with functions.
- Explain Internal Energy, First Law & various processes.
- Applications of First Law: General Relation between C_P and C_V.
- Explain Work Done during Isothermal and Adiabatic Processes.
- **Activities**
- Provided hand written notes
- Presentation of group of students on respective topics assigned to them.
- *Conducting Continuous internal assessment test First (CIA - I).*
- ***Points for discussion:*** Zeroth and First Law of Thermodynamics. Concept of Temperature Work & Heat. First Law of Thermodynamics and its differential form and application Work Done during Isothermal and Adiabatic Processes

References:

- Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, McGraw-Hill.
- Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger, Narosa.
- Thermal Physics, S. Garg, R. Bansal and Ghosh, Tata McGraw-Hill
- *Statistical Physics, Reif, F.,* Tata McGraw-Hill, 2008
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, Springer.
- A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, Indian Press
- Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, Oxford University Press

Unit	Topic	Method	No. of Lectures
II	Entropy: Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy.	Lecture, discussion	02
	Entropy of a perfect gas. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe.	do	03
	Principle of Increase of Entropy. Third Law of Thermodynamics. Unattainability of Absolute zero of temperature	do	03
	Thermodynamic Variables: Extensive and Intensive Thermodynamic Variables. Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Their Properties and Applications	do	03
	Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Their Definitions, Properties and Applications	do	02
	Maxwell's Thermodynamic Relations: Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values of Cp-Cv	do	02
	Assignments by the students	Presentation discussion	02

Learning Outcomes

On concluding the unit-II Students shall be able to understand the following topics

- Concept of Entropy, Clausius Theorem and Inequality, Second Law of Thermodynamics in terms of Entropy.
- Entropy of a perfect gas. Principle of Increase of Entropy.Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe.
- Third Law of Thermodynamics. Unattainability of Absolute temperature.
- Extensive and Intensive Thermodynamic Variables. Thermodynamic Potentials:Their Definitions, Properties and Applications.
- Maxwell's Thermodynamic Relations: Clausius Clapeyron equation, Values of Cp-Cv,.

Activities

- Provided hand written notes
- Presentation of group of students on respective topics assigned to them.
- *Conducting Continuous internal assessment test second (CIA - II).*
- *Points for discussion: Concept of Entropy, Clausius Theorem. Clausius Inequality and Second Law of Thermodynamics.* Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes, Third Law of Thermodynamics and Unattainability of Absolute zero, Thermodynamic Potentials and its Applications, *Maxwell's Thermodynamic Relations and its application.*

References:

- Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, McGraw-Hill.
- Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger, Narosa.

- Thermal Physics, S. Garg, R. Bansal and Ghosh, Tata McGraw-Hill
- *Statistical Physics, Reif, F.,* Tata McGraw-Hill, 2008
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, Springer.
- A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, Indian Press
- Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, Oxford University Press

Unit	Topic	Method	No. of Lectures
III	Distribution of Velocities: Maxwell-Boltzmann Law of Velocities Distribution of Velocities in an Ideal Gas and its Experimental Verification.	Lecture, discussion	02
	Distribution of Velocities in an Ideal Gas and its Experimental Verification.	do	02
	Doppler Broadening of Spectral Lines and Stern's Experiment. Mean, RMS and Most Probable Speeds	do	03
	Degrees of Freedom. Law of Equipartition of Energ. Specific heats of Gases	do	02
	Molecular Collisions: Mean Free Path. Collision Probability. Estimates of Mean Free Path	do	02
	Transport Phenomenon in: Viscosity, Thermal Conductivity and Diffusion. Brownian Motion and its Significance.	do	03
	Assignments by the students	Presentation discussion	02

Learning Outcomes

After going through this unit, you will be able to:

- General velocity distribution, Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas.
- Doppler Broadening of Spectral Lines and Stern's Experiment. Mean Speeds, RMS and Most Probable Speeds.
- Degrees of Freedom Law of Equipartition of Energy, Specific heats of Gases.
- Explain Molecular Collisions: Estimates of Mean Free Path,
- Transport Phenomena : Viscosity, Thermal Conductivity and Diffusion.
- Brownian Motion and its Significance.

Activities

- Provided hand written notes
- Presentation and discussion group of students on respective topics assigned to them.
- *Conducting Continuous internal assessment test Third (CIA - III).*

- ***Points for discussion:*** *Distribution of Velocities, Doppler Broadening of Spectral Lines Mean-, Root Mean Square- and Most Probable Speeds,Transport Phenomenon :Viscosity, Thermal Conductivity and Diffusion. Brownian Motion and its Significance.*

References:

- Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, McGraw-Hill.
- Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger, Narosa.
- Thermal Physics, S. Garg, R. Bansal and Ghosh, Tata McGraw-Hill
- *Statistical Physics, Reif, F.,* Tata McGraw-Hill, 2008
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, Springer.
- A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, Indian Press
- *Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, Oxford University Press*

Unit	Topic	Method	No. of Lectures
IV	Behavior of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation. Andrew's Experiments on CO2 Gas	Lecture, discussion	03
	Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas, Boyle Temperature.	do	02
	Van der Waal's Equation of State for Real Gases. Values of Critical Constants	do	02
	Law of Corresponding States. Comparison with Experimental Curves. P-V Diagrams. Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas	do	03
	Joule-Thomson Porous Plug Experiment. Joule- Thomson Effect for Real and Van der Waal Gases.	do	02
	Boyle Temperature. Temperature of Inversion. And relation between them	do	01
	Assignments by the students	Presentation discussion	02

Learning Outcomes

After going through this unit, you will be able to:

- Behavior of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation.
- Critical Constants, Boyle Temperature,
- Van der Waal's Equation of State for Real Gases.
- Discussion on Law of Corresponding States.
- Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas.
- Joule-Thomson Porous Plug Experiment.
- Joule- Thomson Effect for Real and Van der Waal Gases.

Activities

- Provided hand written notes
- Presentation and discussion group of students on respective topics assigned to them.

- *Conducting Continuous internal assessment test Four (CIA --IV- Optional).*
- ***Points for discussion:*** *Behavior of Real Gases,Critical Constants, Boyle Temperature, Van der Waal's Equation of State for Real Gases, Porous Plug Experiment, Free Adiabatic Expansion of a Perfect Gas.*

References:

- Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, McGraw-Hill.
- Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger, Narosa.
- Thermal Physics, S. Garg, R. Bansal and Ghosh, Tata McGraw-Hill
- Statistical Physics, *Reif, F.,* Tata McGraw-Hill, 2008
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, Springer.
- A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, Indian Press
- *Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, Oxford University Press*

COURSE TITLE**:** ***ELEMENTS OF MODERN PHYSICS (PHYSICS-VII)***

COURSE CODE : ***PHY-CC-401***

Unit	Topic	Method	No. of Lectures
I	Stability of atom; Black-body Radiation: Quantum theory of Light, Planck's quantum, Planck's constant	Lecture, discussion	03
	Light as a collection of photons; Photo-electric effect and Compton scattering.	do	02
	De Broglie wavelength and matter waves; Davison-Germer experiment. Wave description of particles by wave packets	do	03
	Group and Phase velocities and relation between them. Two-Slit experiment with electrons.	do	02
	Probability. Wave amplitude and wave functions.	do	02
	Problems solved on the above topics	do	02
	Assignments by the students	Presentation discussion	02

Learning Outcomes

On concluding the unit-I Students shall be able to understand the following points

- Black body radiation emission and absorption of radiation.
- Spectrum of black body radiation.
- Quantum nature of electromagnetic radiation.
- Wave-particle duality.
- **Activities**
- ***Points of discussion :*** *nature of the spectrum of radiation emitted by black-body wave nature of matter and radiation, two-slit experiment and the concept of wave function.*

- *Conducting Continuous internal assessment test first (CIA - I).*

Reference Books(Latest Edition):

- Concepts of Modern Physics, Arthur Beiser, McGraw-Hill.
- Introduction to Modern Physics, Rich Meyer, Kennard, Coop,, Tata McGraw Hill
- Introduction to Quantum Mechanics, David J. Griffith, Pearson Education.
- Theory and Problems of Modern Physics, Schaum`s outline, R. Gautreau and W. Savin, Tata McGraw-Hill Publishing Co. Ltd.

Unit	Topic	Method	No. of Lectures
	Position measurement- gamma ray microscope; Wave-particle duality,	Lecture, discussion	02
	Heisenberg uncertainty principle, derivation from Wave Packets;	do	02
	Estimating minimum energy of a confined particle using uncertaintyprinciple; Energy-time uncertainty principle-application to virtual particles and range of an	do	03

Learning Outcomes

On concluding the unit-I Students shall be able to understand the following points

- Heisenberg uncertainty principle : simultaneous measurement of position and momentum
- Concept of Wave Packets.
- Wave equation governing microscopic particles .
- Wave-particle duality.
- **Activities**
- ***Points of discussion*** *: simultaneous measurement of position and momentum, energy and time virtual particles, dual nature of matter, operators in quantum mechanics and the physical interpretation of wave function, probabilities and normalization*
- *Conducting Continuous internal assessment test Second (CIA - II).*

Reference Books(Latest Edition):

- Concepts of Modern Physics, Arthur Beiser, McGraw-Hill.
- Introduction to Modern Physics, Rich Meyer, Kennard, Coop,, Tata McGraw Hill
- Introduction to Quantum Mechanics, David J. Griffith, Pearson Education.
- *Theory and Problems of Modern Physics, Schaum`s outline, R. Gautreau and W. Savin, Tata McGraw-Hill Publishing Co. Ltd.*

Unit	Topic	Method	No. of Lectures
III	Particle in One-dimensional box with infinite walls- energy states; Quantum dot as example	Lecture, discussion	02
	Quantum mechanical scattering and tunneling in one dimension-across a step potential	do	03
	Rectangular potential barrier, with different cases	do	02
	Lasers:. Meta-stable states. Spontaneous and Stimulated emissions. Optical, Pumping and Population Inversion.	do	02
	Einstein's A and B coefficients derivation from plank's radiation law	do	02
	Three-Level and Four-Level Lasers. Ruby Laser and He-Ne Laser.	do	02
	Assignments by the students	Presentation discussion	02

Learning Outcomes

On concluding the unit-III Students shall be able to understand the following points

- Particle in One-dimensional box with infinite walls- energy states; Quantum dot as example
- Phenomenon of quantum mechanical tunneling.
- Coefficients of Spontaneous and Stimulated emissions. Optical, Pumping and Population Inversion.
- Types of lasers and their application in day to day life.
- **Activities**

  Points of discussion were : Energy spectrum of the particle in one-dimensional box and its eigenfunction, quantum mechanical tunneling, laser action, meta-stable state, population inversion, spontaneous and stimulated emmision
- *Conducting Continuous internal assessment test Second (CIA - III).*

Reference Books(Latest Edition):

- Concepts of Modern Physics, Arthur Beiser, McGraw-Hill.
- Introduction to Modern Physics, Rich Meyer, Kennard, Coop,, Tata McGraw Hill
- Introduction to Quantum Mechanics, David J. Griffith, Pearson Education.
- *Theory and Problems of Modern Physics, Schaum`s outline, R. Gautreau and W. Savin, Tata McGraw-Hill Publishing Co. Ltd.*

Unit	Topic	Method	No. of Lectures
IV	Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle	Lecture, discussion	02
	Radioactivity: stability of the nucleus; Law of radioactive decay; Mean life and half-life; Alpha decay;	do	03
	Alpha decay;Beta decay- energy released, spectrum and Pauli's prediction of neutrino	do	03
	Fission and fusion- mass deficit,binding energy; Fission - nature of fragments and emission of neutrons.	do	02
	Nuclear reactor: slow neutrons interacting with Uranium 235;	do	02
	Fusion and thermonuclear reactions driving stellar energy (brief qualitative discussions).	do	02
	Assignments by the students	Presentation discussion	02

Learning Outcomes

On concluding the unit-IV Students shall be able to understand the following points

- Structure and constitution of atomic nucleus and its properties
- Non-existence of electron in the nucleus .
- Decay of unstable nuclei to the stable ones
- Types of decays, energy spectrum in beta-decay
- Fission and fusion- mass deficit,binding energy;
- Construction and working of Nuclear reactor
- Energy generation in sun and other stars
- **Activities**

- ***Points of discussion were :*** *Structure and properties of nucleus, Radio-activity, radiometric dating of geological sample, nuclear reactions Energy generation from nuclear reactions*
- *Conducting Continuous internal assessment test Second (CIA – IV - Optional).*

Reference Books(Latest Edition):

- Concepts of Modern Physics, Arthur Beiser, McGraw-Hill.
- Introduction to Modern Physics, Rich Meyer, Kennard, Coop,, Tata McGraw Hill
- Introduction to Quantum Mechanics, David J. Griffith, Pearson Education.
- *Theory and Problems of Modern Physics, Schaum`s outline, R. Gautreau and W. Savin, Tata McGraw-Hill Publishing Co. Ltd.*

*CONCERNED TEACHER**: Dr. Khalid Sultan***

PHY-CC-101: MECHANICS

Unit	Topic	Method	No. of classes needed
I	Reference frames. Inertial frames, Review of Newton's Laws of Motion.	Lecture and Discussion	02
	Centre of Mass. Principle of conservation of momentum.	do	02
	Work and Kinetic Energy Theorem. Conservative and non- conservative forces.	do	02
	Potential Energy. Energy diagram. Stable and unstable equilibrium	do	02
	Elastic potential energy. Force as gradient of potential energy.	do	02
	Work & Potential energy. Work done by non-conservative forces.	do	02
	Law of conservation of Energy.	do	02

Learning Outcomes

After going through this unit student shall be able to Know:

- To Understand Fundamentals of Dynamics e.g. Reference frames. Inertial frames, Review of Newton's Laws of Motion. Dynamics of a system of particles.
- Centre of Mass. Principle of conservation of momentum. Impulse.
- To Understand Work and Energy: Work and Kinetic Energy Theorem. Conservative and non-conservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium.
- Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by non-conservative forces. Law of conservation of Energy.

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Activities

1. Preparation of assignment on particular topics;
2. Discussions on Numerical based questions;

Units	Topic	Method	No. of Classes Needed
II	Angular momentum of a particle and system of particles.	Lecture and Discussion	02
	Torque. Principle of conservation of angular momentum.	do	02
	Rotation about a fixed axis. Moment of Inertia.	do	02

	Calculation of moment of inertia for rectangular, cylindrical and spherical bodies	do	02
	Kinetic energy of rotation. Motion involving both translation and rotation.	do	02
	Relation between Elastic constants.	do	02
	Twisting torque on a Cylinder or Wire.	do	02

Learning Outcomes

After going through this unit student shall be able to Know:

- To Understand Rotational Dynamics: Angular momentum of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia.
- Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation.
- To understand Elasticity: Relation between Elastic constants. Twisting torque on a Cylinder or Wire.

Activities

1. Preparation of assignment on particular topics;
2. Discussions on Numerical based questions;

Units	Topic	Method	No. of Classes Needed
III	Law of gravitation and Gravitational potential energy.	Lecture and Discussion	02
	Inertial and gravitational mass.	do	02
	Potential and field due to spherical shell and solid sphere.	do	02
	Motion of a particle under a central force field.	do	02
	Two-body problem and its reduction to one-body problem and its solution. The energy equation and	do	02

	energy diagram.		
	Kepler’s Laws. Satellite in circular orbit applications.	do	02
	Elastic and inelastic collisions between particles	do	02

Learning Outcomes

- To Understand Gravitation and Central Force Motion: Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere.
- To Understand Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram.
- Kepler’s Laws. Satellite in circular orbit applications.
- Collisions: Elastic and inelastic collisions between particles.

Activities

1. Preparation of assignment on particular topics;
2. Discussions on Numerical based questions;

Units	Topic	Method	No. of Classes Needed
IV	**Special Theory of Relativity:** Michelson-Morley Experiment and its outcome.	Lecture and Discussion	02
	Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events.	do	02
	Lorentz contraction. Time dilation.	do	02
	Relativistic transformation of velocity, frequency and wave number	do	02
	Relativistic addition of velocities. Variation of mass with velocity. Massless Particles.	do	02
	Mass-energy Equivalence. Relativistic Doppler effect. Relativistic Kinematics.	do	02

	Transformation of Energy and Momentum. Energy - Momentum Four Vector.	do	02

Learning Outcomes

- To Understand Special Theory of Relativity: Michelson-Morley Experiment and its outcome.
- To Understand Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation.
- Relativistic addition of velocities. Variation of mass with velocity. Massless Particles.
- Transformation of Energy and Momentum. Energy - Momentum Four Vector.

Activities

1. Preparation of assignment on particular topics;
2. Discussions on Numerical based questions;

Text Books:

1. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, McGraw-Hill.
2. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. Tata McGraw-Hill.

References:

1. Mechanics, D.S. Mathur, S. Chand and Company Limited 2000
2. University Physics. F.W Sears, M.W Zemansky, H.D Young, 1986, Addison Wesley
3. Physics, Resnik, Halliday and Walker, Wiley.
4. Analytical Mechanics, G.R.Fowle and G.L. Cassiday. 2005, Cengage Learning.
5. Feynman Lectures, Vol. I, R. P. Feynman, R. B. Leighton, M. Sands, Pearson Education
6. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole
7. Feynman Lectures, Vol. I, R. P. Feynman, R. B. Leighton, M. Sands, Pearson Education
8. Introduction to Special Relativity, R. Resnick, John Wiley and Sons.
9. Mechanics, D.S. Mathur, S. Chand and Company Limited.
10. University Physics, F. W Sears, M.W Zemansky, H. D Young, Addison Wesle
*1*1. Physics for scientists and Engineers with Modern Phys., J. W. Jewett, R. A. Serway, Cengage Learning

PHY-CC-201: WAVES & OSCILATIONS

Unit	Topic	Method	No. of classes needed
I	Simple Harmonic Oscillations. Differential Equation of SHM and its Solution.	Lecture and Discussion	02
	Amplitude, Frequency, Time Period and Phase. Velocity and Acceleration. Kinetic, Potential and Total Energy and their Time Average Values. Reference Circle. Rotating Vector Representation of SHM.	do	02
	Free Oscillations of Systems with One Degree of Freedom :- (1) Mass-Spring system, (2) Simple Pendulum, (3) Torsional Pendulum,	do	02
	(4) Oscillations in a U-Tube (5) Compound pendulum: Centres of Percussion and Oscillation, and (6) Bar Pendulum.	do	02
	Superposition of Two Collinear Harmonic Oscillations :- Linearity and Superposition Principle	do	02
	(1) Oscillations having Equal Frequencies and (2) Oscillations having Different Frequencies (Beats).	do	02
	Superposition of N Collinear Harmonic Oscillations with (1) Equal Phase Differences and (2) Equal Frequency Differences.	do	02

Learning Outcomes

After going through this unit student shall be able to Know:

- SHM :- Simple Harmonic Oscillations. Differential Equation of SHM and its Solution. Amplitude, Frequency, Time Periodand Phase. Velocity and Acceleration. Kinetic, Potential and Total Energy and their Time Average Values.
- Reference Circle. Rotating Vector Representation of SHM. Free Oscillations of Systems with One Degree of Freedom :- (1) Mass-Spring system, (2) Simple Pendulum, (3) Torsional Pendulum, (4) Oscillations in a U-Tube (5) Compound pendulum: Centres of Percussion and Oscillation, and (6) BarPendulum.
- Superposition of Two Collinear Harmonic Oscillations :- Linearity and Superposition Principle. (1) Oscillations having Equal Frequencies and (2) Oscillations having Different Frequencies (Beats).
- Superposition of N Collinear Harmonic Oscillations with (1) Equal Phase Differences and (2) Equal Frequency Differences.

Activities

- Preparation of assignment on particular topics;

- Discussions on Numerical based questions;

Units	Topic	Method	No. of Classes Needed
II	System with Two Degrees of Freedom: Coupled Oscillators.	Lecture and Discussion	02
	Normal Coordinates and Normal Modes.	do	02
	Energy Relation and Energy Transfer. Normal Modes of N Coupled Oscillators.	do	02
	Free Oscillations. Damped Oscillations : Damping Coefficient,	do	02
	Log Decrement. Forced Oscillations : Transient and Steady States,	do	02
	Amplitude, Phase, Resonance, Sharpness of Resonance,	do	02
	Power Dissipation and Quality Factor. Helmholtz Resonator.	do	02

Learning Outcomes

After going through this unit student shall be able to Know:

3. System with Two Degrees of Freedom : Coupled Oscillators. Normal Coordinates and Normal Modes.
4. Energy Relation and Energy Transfer. Normal Modes of N Coupled Oscillators.
5. Free Oscillations. Damped Oscillations : Damping Coefficient, Log Decrement. Forced Oscillations : Transient and Steady States
6. Amplitude, Phase, Resonance, Sharpness of Resonance, Power Dissipation and Quality Factor. Helmholtz Resonator.

Activities

- Preparation of assignment on particular topics;
- Discussions on Numerical based questions;

Units	Topic	Method	No. of Classes Needed
III	Wave Motion :- Plane and Spherical Waves. Longitudinal and Transverse Waves.	Lecture and Discussion	02

	Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation.	do	02
	Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave.	do	02
	Water Waves : Ripple and Gravity Waves.	do	02
	Velocity of Waves :- Velocity of Transverse Vibrations of Stretched Strings.	do	02
	Velocity of Longitudinal Waves in a Fluid in a Pipe.	do	02
	Newton's Formula for Velocity of Sound. Laplace's Correction.	do	02

Learning Outcomes

After going through this unit student shall be able to Know:

- Wave Motion :- Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves.
- Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport.
- Intensity of Wave. Water Waves : Ripple and Gravity Waves.
- Velocity of Waves :- Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe.
- Newton's Formula for Velocity of Sound. Laplace's Correction.

Activities

Preparation of assignment on particular topics;
Discussions on Numerical based questions;

Units	Topic	Method	No. of Classes Needed
IV	Superposition of Two Harmonic Waves :- Standing (Stationary) Waves in a String : Fixed and Free Ends.	Lecture and Discussion	02
	Analytical Treatment. Phase and Group Velocities.	do	02

	Changes wrt Position and Time. Energy of Vibrating String. Transfer of Energy	do	02
	Normal Modes of Stretched Strings.	do	02
	Plucked and Struck Strings. Meldes Experiment.	do	02
	Longitudinal Standing Waves and Normal Modes.	do	02
	Open and Closed Pipes. Superposition of N Harmonic Waves.	do	02

Learning Outcomes

After going through this unit student shall be able to Know:

3. Superposition of Two Harmonic Waves :- Standing (Stationary) Waves in a String : Fixed and Free Ends. Analytical Treatment.
4. Phase and Group Velocities. Changes wrt Position and Time. Energy of Vibrating String. Transfer of Energy.
5. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment. Longitudinal Standing Waves and Normal Modes.
6. Open and Closed Pipes. Superposition of N Harmonic Waves.

Activities

- Preparation of assignment on particular topics;
- Discussions on Numerical based questions;

Reference Books (Eatest Edition):

1. Vibrations and Waves by A. P. French., CBS Pub. & Dist.
2. The Physics of Waves and Oscillations by N.K. Bajaj,Tata McGraw-Hill.
3. Fundamentals of Waves & Oscillations By K. Uno Ingard, Cambridge University Press.
4. An Introduction to Mechanics by Daniel Kleppner, Robert J. Kolenkow McGraw-Hill.
5. Waves: BERKELEY PHYSICS COURSE (SIE) by Franks Crawford Tata McGrawHill.

Dr. Vijay Raj Singh
COURSE TITLE**: Thermal Physics** ***(PHYSICS-III)***
COURSE CODE : ***PHY-CC-201***

Unit	Topic	Method	No. of classes needed
I	Zeroth and First Law of Thermodynamics.	Lecture, quiz, discussion & assignment	02
	Concept of Temperature, Concept of Work & Heat, State Functions.	do	02
	First Law of Thermodynamics and its differential form.	do	02
	Internal Energy, First Law & various processes	do	02
	Applications of First Law: General Relation between C_P and C_V	do	03
	Work Done during Isothermal and Adiabatic Processes	do	02

Learning Outcomes

After going through this unit, student shall be able to:

. Explain Zeroth and First Law of Thermodynamics.
. Distinguish between concepts of Temperature Work & Heat.
. Explain State Functions.
. Explain First Law of Thermodynamics and its differential form.
. Define measurement and evaluation with functions.
. Explain Internal Energy, First Law & various processes.
. Applications of First Law: General Relation between C_P and C_V.
. Explain Work Done during Isothermal and Adiabatic Processes.

Activities

. Provided hand nots
. Took Quiz;
. Took Pregentation on some particular topic.
. Took CIT-1

Points for discussion

. Zeroth and First Law of Thermodynamics.
. Concept of Temperature Work & Heat.
. First Law of Thermodynamics and its differential form and application
. Work Done during Isothermal and Adiabatic Processes?

References:

1) Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, McGraw-Hill.
2) A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, Indian Press
3) Thermal Physics, S. Garg, R. Bansal and Ghosh, Tata McGraw-Hill
4) Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, Springer.
5) Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger, Narosa.
6) Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, Oxford University Press

Units	Topic	Method	No. of Classes Needed
II	Entropy: Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy.	Lecture, quiz, discussion & assignment	04
	Entropy of a perfect gas. Principle of Increase of Entropy.Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe. Entropy Changes in Reversible and Irreversible Processes	do	04

	Principle of Increase of Entropy. Third Law of Thermodynamics. Unattainability of Absolute temperature	do	02
	Thermodynamic Potentials: Extensive and Intensive Thermodynamic Variables. Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Their Definitions, Properties and Applications	do	04
	Maxwell's Thermodynamic Relations: Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values of Cp-Cv,		04

Learning Outcomes

After going through this unit, you will be able to:

- Explain Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy.
- Explain Entropy of a perfect gas. Principle of Increase of Entropy.Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe. Entropy Changes in Reversible and Irreversible Processes.
- Explain Principle of Increase of Entropy. Third Law of Thermodynamics. Unattainability of Absolute temperature.
- Explain Thermodynamic Potentials: Extensive and Intensive Thermodynamic Variables. Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Their Definitions, Properties and Applications.
- Maxwell's Thermodynamic Relations: Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values of Cp-Cv,.

Activities

- Provided hand notes
- Took Quiz;
- Took Presentation on some particular topic.

. Took CIA-2

Points for the discussion:

. Concept of Entropy, Clausius Theorem. Clausius Inequality and Second Law of Thermodynamics.
. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes.
. Third Law of Thermodynamics. Unattainability of Absolute temperature.
. Thermodynamic Potentials and its Applications.
. Maxwell's Thermodynamic Relations and its application.

References

1) Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, McGraw-Hill.
2) A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, Indian Press
3) Thermal Physics, S. Garg, R. Bansal and Ghosh, Tata McGraw-Hill
4) Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, Springer.
5) Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger, Narosa.
6) Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, Oxford University Press

Unit	Topic	Method	No. of classes needed
III	Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification.	Lecture, quiz, discussion & assignment	05
	Doppler Broadening of Spectral Lines and Stern's Experiment. Mean, RMS and Most Probable Speeds	do	05
	Degrees of Freedom. Law of Equipartition of Energy (No proof required). Specific heats of Gases	do	05
	Molecular Collisions: Mean Free Path. Collision Probability. Estimates of Mean Free Path	do	05
	Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian Motion and its Significance.	do	05

Learning Outcomes

After going through this unit, you will be able to:

- Explain Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas.
- Describe the Doppler Broadening of Spectral Lines and Stern's Experiment. Mean, RMS and Most Probable Speeds.
- Explain Degrees of Freedom. Law of Equipartition of Energy (No proof required). Specific heats of Gases.

. Explain Molecular Collisions: Mean Free Path. Collision Probability. Estimates of Mean Free Path,
. Explain Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian Motion and its Significance.

Activities

. Provided hand notes
. Took Quiz;
. Took Presentation on some particular topic;
. Took CIA-3.

Points for discussion:

. Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion.
. Brownian Motion and its Significance.
. Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas

References

1) Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, McGraw-Hill.
2) A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, Indian Press
3) Thermal Physics, S. Garg, R. Bansal and Ghosh, Tata McGraw-Hill
4) Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, Springer.
5) Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger, Narosa.
6) Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, Oxford University Press

Unit	Topic	Method	No. of classes needed
IV	Behavior of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation. Andrew's Experiments on CO2 Gas	Lecture, Discussion/PPT	05
	Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas. Boyle Temperature. Van der Waal's Equation of State for Real Gases. Values of Critical Constants	do	04
	Law of Corresponding States. Comparison with Experimental Curves. p-V Diagrams. Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas	do	03
	Joule-Thomson Porous Plug Experiment. Joule- Thomson Effect for Real and Van der Waal Gases.	do	03
	Temperature of Inversion.	do	01

Learning outcomes

After going through this unit you should be able to:

- Explain Behavior of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation. Andrew's Experiments on CO_2 Gas.
- Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas. Boyle Temperature. Van der Waal's Equation of State for Real Gases. Values of Critical Constants
- Discusson on Law of Corresponding States. Comparison with Experimental Curves. p-V Diagrams. Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas.
- Understand the importance of Joule-Thomson Porous Plug Experiment. Joule- Thomson Effect for Real and Van der Waal Gases.

Activities

- Provided hand notes
- Took Quiz;
- Took Presentation on some particular topic;

Points for discussion

- Joule-Thomson Porous Plug Experiment and Joule- Thomson Effect for Real and Van der Waal Gases.
- Law of Corresponding States. Comparison with Experimental.

References:

1) Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, McGraw-Hill.
2) A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, Indian Press
3) Thermal Physics, S. Garg, R. Bansal and Ghosh, Tata McGraw-Hill
4) Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, Springer.
5) Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger, Narosa.
6) Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, Oxford University Press

PHY-CC-303: Optics

Unit	Topic	Method	No. of classes needed
I	Review of Basic laws of reflection and refraction, types of mirrors and lenses, The principle of reversibility.	Lecture, quiz, discussion & assignment	02
	Fermat's Principle. Thin-Lens: Thin-Lens Combinations.	do	02
	The Power of a Thin Lens, Thin Lenses in Contact, Derivation of the Lens Makers' Formula.	do	02
	Thick Lenses: Focal Points and Principal Points, Conjugate Relations.	do	02
	General Thick-Lens Formulas, Nodal Points and Optical Center, Cardinal Points of optical system.	do	03
	Optical Instruments: The Human Eye, Cameras, Microscopes, Astronomical Telescopes, Eyepieces, Huygens Eyepiece, Ramsden Eyepiece.	do	02

Learning Outcomes

After going through this unit, student shall be able to:

. Explain Fermat's Principle. Thin-Lens: Thin-Lens Combinations.
. Distinguish between The Power of a Thin Lens, Thin Lenses in Contact, Derivation of the Lens Makers' Formula.
. Explain Focal Points and Principal Points, Conjugate Relations.
. Explain General Thick-Lens Formulas, Nodal Points and Optical Center, Cardinal Points of optical system.
.

Activities

. Provided hand nots
. Took Quiz;
. Took Presentation on some particular topic.
. Took CIT-1

Points for discussion

. Fermat's Principle.
. Concept of Focal Points and Principal Points, Conjugate Relations.
. General Thick-Lens Formulas, Nodal Points and Optical Center, Cardinal Points of optical system

. The Power of a Thin Lens?

References:

1. Jenkins and White; “Fundamental of Optics” (McGraw-Hill).
2. A K Ghatak, “Physical Optics” (Tata McGrew Hill).
3. D P Khandelwal; “Optics and Atomic Physics” (Himalaya, Publishing House Bombay).
4. F Smith and JH Thomson; “Manchester Physics sries; Optics” (English Language Book Society and Joh Wiley).
5. Born and Wolf; “Optics” KD Moltey; “Optics” (Oxford University Press).
6.B. K. Johnson, “Optics and Optical Instruments: An Introduction”, , Dover Publications.
7. Eugen Hetch, “Schaum's Outline of Optics” 1st Edition, Mc Graw-Hill Education .

Units	Topic	Method	No. of Classes Needed
II	Interference of light: The principle of superposition, two-slit interference, Intensity distribution, Displacement of fringes.	Lecture, quiz, discussion & assignment	04
	Interference in thin parallel films. Non-reflecting films.	do	04
	Michelson interferometer, its application for precision determination of wavelength.	do	02
	Wavelength difference and width of spectral lines. Multiple beam interference.	do	04
	Fabry Perot interferometer and etalon; Intensity distribution		04

Learning Outcomes

After going through this unit, you will be able to:

. Explain Interference of light: The principle of superposition.
. Explain Interference in thin parallel films. Non-reflecting films.
. Explain Michelson interferometer, its application for precision determination of wavelength.
. Explain Wavelength difference and width of spectral lines. Multiple beam interference.
. Fabry Perot interferometer and etalon,.

Activities

. Provided hand notes
. Took Quiz;
. Took Presentation on some particular topic.
. Took CIA-2

Points for the discussion:

- Concept Fabry Perot interferometer and etalon.
- Michelson interferometer.
- Interference in thin parallel films. Non-reflecting films.
- Interference of light.
- The principle of superposition.

References

1) Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, McGraw-Hill.
2) A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, Indian Press
3) Thermal Physics, S. Garg, R. Bansal and Ghosh, Tata McGraw-Hill
4) Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, Springer.
5)Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger, Narosa.
6) Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, Oxford University Press

Learning Outcomes

After going through this unit, you will be able to:

- Explain Fraunhoffer diffraction.
- Describe two slit Diffraction pattern, intensity distribution. Diffraction gratings.
- Explain Diffraction at N parallel slits, intensity distribution at an N parallel slits. Plane diffraction grating Resolution of images.

Unit	Topic	Method	No. of classes needed
III	Fraunhoffer diffraction: diffraction at a slit, the intensity distribution. Diffraction at a circular aperture	Lecture, quiz, discussion & assignment	05
	Two slit Diffraction pattern, intensity distribution. Diffraction gratings.	do	05
	Diffraction at N parallel slits, intensity distribution at an N parallel slits. Plane diffraction grating Resolution of images.	do	05
	Rayleigh criterion, resolving power of telescopic and microscopic systems.	do	05
	Resolving power of a grating.	do	05

Rayleigh criterion, resolving power of telescopic and microscopic systems.

. Explain Resolving power of a grating..

Activities

. Provided hand notes
. Took Quiz;
. Took Presentation on some particular topic;
. Took CIA-3.

Points for discussion:

. Rayleigh criterion, resolving power of telescopic and microscopic systems.

. Fraunhoffer diffraction.

3. Two slit Diffraction pattern

References

1) Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, McGraw-Hill.
2) A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, Indian Press
3) Thermal Physics, S. Garg, R. Bansal and Ghosh, Tata McGraw-Hill
4) Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, Springer.
5) Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger, Narosa.
6) Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, Oxford University Press

Unit	Topic	Method	No. of classes needed
IV	Fresnel diffraction: Fresnel half-period zones, The Zone-Plate.	Lecture, Discussion/ PPT	05
	Diffraction at a circular aperture, Rectilinear propagation of light	do	04
	Diffraction by a straight edge (analysis using half-period zones).	do	03
	Polarization by reflection, Malus's law. Double refraction, Refraction in Uni-axial crystals. Optical activity,	do	03
	Rotation of plane of polarization. Origin of optical rotation in liquids and in crystals.	do	01

Learning outcomes

After going through this unit you should be able to:

. Diffraction at a circular aperture, rectilinear propagation of light.
. Diffraction by a straight edge (analysis using half-period zones).
. Discussion on Polarization by reflection, Malus's law. Double refraction, Refraction in Uni-axial crystals. Optical activity,.
. Understand Rotation of plane of polarization. Origin of optical rotation in liquids and in crystals.

Activities

. Provided hand notes
. Took Quiz;
. Took Presentation on some particular topic;

Points for discussion

. Fresnel diffraction: Fresnel half-period zones, The Zone-Plate.
. Law of Corresponding States. Comparison with Experimental.

References:

1) Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, McGraw-Hill.
2) A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, Indian Press
3) Thermal Physics, S. Garg, R. Bansal and Ghosh, Tata McGraw-Hill
4) Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, Springer.
5) Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger, Narosa.
6) Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, Oxford University Press

Mr. Vikas Kumar

Assistant Professor

PHY-CC-301: BASIC ELECTRONICS

Unit	Topic	Method	No. of classes needed
I	Energy band description of semiconductor, charge carriers	Lecture and Discussion	02
	Intrinsic and extrinsic semiconductors, charge concentration	do	02
	Temperature dependence of carrier concentration	do	02
	Electrical conductivity and Mobility	do	01
	Carrier Concentration and Fermi level of intrinsic Semiconductor	do	02
	Donor and Acceptor, Fermi level, Fermi level in extrinsic semiconductor	do	02
	Idea of carrier mobility, Drift and Diffusion current	do	02
	Hall effect	do	02
	Numerical problems	Assignment	

Learning Outcomes

After going through this unit student shall be able to Know:

- Energy band theory of semiconductors, charge carriers.
- Intrinsic and extrinsic semiconductors, charge concentration.
- Temperature dependence of carrier concentration.
- Concept of electrical conductivity and Mobility.
- Fermi level of intrinsic Semiconductor.
- Donor and Acceptor atoms, Fermi level in extrinsic semiconductor.

Activities

1. Preparation of assignment on particular topics;

2. Provided hand notes;
3. Discussions on Numerical based questions;

Points for discussion:

- Hall Effect in metal and semiconductors.

References:

- Solid state physics and Electronics, R.K Puri and V.K. Babbar, S Chand.
- Principles of Electronics by Mehta V. K. (S.Chand and Company LTD).
- Electronic Principles by Malvino A.P .(Tata McGraw-Hill Publishing LTD).
- Basic Electronics by Grob Bernard.(Tata McGraw-Hill Publishing LTD).
- Basic Electronics by Thareja B.L. (S.Chand and Company LTD).

Units	Topic	Method	No. of Classes Needed
II	Diodes: P-N junction: barrier formation, barrier potential	Lecture and Discussion	01
	Current Flow Mechanism in Forward and Reverse Biased Diode	do	02
	P-N junction and its characteristics. Diode equation	do	02
	Qualitative mechanisms of junction breakdown: avalanche breakdown and zener breakdown	do	02
	Zener diode. Zener diode as voltage stabilizer	do	01
	Half wave and full wave rectifier, ripple factor, rectification efficiency	do	01
	Numerical problems	Assignment	

Learning Outcomes

After going through this unit, you will be able to Understand:

- Barrier formation, barrier potential, and P-N junction.
- Current Flow Mechanism in Forward and Reverse Biased Diode.
- Characteristics of P-N junction. Diode equation.
- Qualitative mechanisms of junction breakdown: avalanche breakdown and zener breakdown.
- What are voltage stabilizers? Zener diode. Zener diode as voltage stabilizer.
- Half wave and full wave rectifier, ripple factor, rectification efficiency.

Activities

1. Preparation of assignment on particular topics;
2. Provided hand notes;
3. Discussions on Numerical based questions;

Points for discussion:

- P-N junction.
- Diode equation.

References:

1. Solid state physics and Electronics, R.K Puri and V.K. Babbar, S Chand.
2. Principles of Electronics by Mehta V. K. (S.Chand and Company LTD).
3. Electronic Principles by Malvino A.P .(Tata McGraw-Hill Publishing LTD).
4. Basic Electronics by Grob Bernard.(Tata McGraw-Hill Publishing LTD).
5. Basic Electronics by Thareja B.L. (S.Chand and Company LTD).

Units	Topic	Method	No. of Classes Needed
III	Bipolar Junction transistors	Lecture and Discussion	01
	n-p-n and p-n-p Transistors	do	02
	Characteristics of CB, CE Configurations	do	02
	Current gains α, β and γ and Relations between them	do	02
	Load Line Analysis of Transistors	do	01
	DC Load line and Q-point	do	01
	Physical Mechanism of Current Flow. Active, Cutoff, and Saturation Regions.	do	01
	Amplifiers: Transistor as an amplifier in CE arrangement	do	01
	Numerical problems	Assignment	

Learning Outcomes

After going through this unit, you will be able to:

Understand Bipolar Junction transistors.
Differentiate between n-p-n and p-n-p Transistors.
Characteristics of CB, CE Configurations.
Load Line Analysis of Transistors, DC and AC load line, Q-point.
Transistor as an amplifier in CE arrangement.

Activities

1. Preparation of assignment on particular topics;

2. Provided hand notes;
3. Discussions on Numerical based questions;

Points for discussion:

1. Active, Cutoff, and Saturation Regions**.**
2. Difference between DC Load line and AC load line.

References

1. Solid state physics and Electronics, R.K Puri and V.K. Babbar, S Chand.
2. Principles of Electronics by Mehta V. K. (S.Chand and Company LTD).
3. Electronic Principles by Malvino A.P .(Tata McGraw-Hill Publishing LTD).
4. Basic Electronics by Grob Bernard.(Tata McGraw-Hill Publishing LTD).
5. Basic Electronics by Thareja B.L. (S.Chand and Company LTD)

Unit	Topic	Method	No. of classes needed
IV	Field Effect Transistor: Construction, working and characteristics of JFET	Lecture and Discussion	02
	various parameters of JFET, JFET as an amplifier	do	02
	Advantage of JFET over BJT	do	02
	Basic construction of MOSFET and its working	do	02
	physical explanation of characteristics	do	01
	Enhancement and depletion modes of MOSFET	do	01
	Numerical problems	Assignment	

Learning outcomes

After going through this unit you should be able to:

7. Learn Field Effect Transistor: Construction, working and characteristics of JFET.
8. Differentiate between unipolar and bipolar transistors.
9. Understand the various parameters of JFET, JFET as an amplifier.
10. What is the advantage of JFET over BJT?
11. Basic construction of MOSFET and its working.

Activities

1. Preparation of assignment on particular topics;
2. Provided hand notes;
3. Discussions on Numerical based questions;

Points for discussion

- Construction and working of MOSFET.

References:

1. Solid state physics and Electronics, R.K Puri and V.K. Babbar, S Chand.
2. Principles of Electronics by Mehta V. K. (S.Chand and Company LTD).
3. Electronic Principles by Malvino A.P .(Tata McGraw-Hill Publishing LTD).
4. Basic Electronics by Grob Bernard.(Tata McGraw-Hill Publishing LTD).
5. Basic Electronics by Thareja B.L. (S.Chand and Company LTD).

PHY-CC-403: ELECTROMAGNETIC THEOREY

Unit	Topic	Method	No. of classes needed
I	Maxwell's equations and Displacement Current	Lecture and Discussion	01
	Vector and Scalar Potentials, Gauge Transformations: Lorentz and Coulomb Gauge	do	01
	Boundary Conditions at Interface between Different Media	do	01
	Wave Equations, Plane Waves in Dielectric Media	do	01
	Poynting Theorem and Poynting Vector, Electromagnetic Energy Density	do	02
	Physical Concept of Electromagnetic Field Energy Density, Momentum Density and Angular Momentum Density	do	02
	Plane EM waves through vacuum and isotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance	do	02
	Propagation through conducting media, relaxation time, skin depth	do	02
	Wave propagation through dilute plasma, electrical conductivity of ionized gases, plasma frequency, refractive index, skin depth, application to propagation through ionosphere	do	02

Learning Outcomes

After going through this unit student shall be able to Know:

- Maxwell's equations and the modification in Ampere's law and Displacement Current,
- Vector and Scalar Potentials.
- Gauge Transformations: Lorentz and Coulomb Gauge,
- Wave Equations, plane wave,
- Work energy theorem in electrodynamics and Poynting Vector,
- Physical Concept of Electromagnetic Field Energy Density, Momentum Density and Angular Momentum Density.
- Plane EM waves through vacuum, isotropic medium and conducting media and its properties such as refractive index, dielectric constant, relaxation time, skin depth.
- Wave propagation through dilute plasma, electrical conductivity of ionized gases, plasma frequency, refractive index, skin depth.

Activities

4. Preparation of assignment on particular topics;
5. Provided hand notes;
6. Discussions on Numerical based questions;

Points for discussion:

- Why do we use Maxwell stress tensors?
- Find the divergence of Maxwell stress tensors.
- What is Tensor? Discuss the difference between vectors and Tensors.

References:

- Introduction to Electrodynamics, D.J. Griffiths, Benjamin Cummings.
- Elements of Electromagnetic, M.N.O. Sadiku, Oxford University Press.

Units	Topic	Method	No. of Classes Needed
II	Boundary conditions at a plane interface between two media	Lecture and Discussion	01
	Reflection & Refraction of plane waves at plane interface between two dielectric media-Laws of Reflection & Refraction	do	02
	Fresnel's Formulae For perpendicular polarization cases	do	02
	Fresnel's Formulae for parallel polarization cases	do	02
	Brewster's law and Reflection & Transmission coefficients	do	01
	Total internal reflection and its conditions, evanescent waves	do	01
	Metallic reflection (normal Incidence)	do	02

Learning Outcomes

After going through this unit, you will be able to Understand:

- Continuity and discontinuity of electric and magnetic field between two different medium at interface plane.
- Reflection & Refraction of plane waves at plane interface between two dielectric media-Laws of Reflection & Refraction.
- Parallel and Perpendicular polarization, Fresnel's Formulae for both the cases.

Unit	Topic	Method	No. of classes needed
III	Description of Linear, Circular and Elliptical Polarization	Lecture and Discussion	01
	Propagation of E.M. Waves in Anisotropic Media	do	01
	Symmetric Nature of Dielectric Tensor	do	01
	Uniaxial and Biaxial Crystals, Light Propagation in Uniaxial Crystal	do	01
	Double Refraction. Polarization by Double Refraction. Nicol Prism.	do	01
	Ordinary & extraordinary refractive indices	do	01
	Production & detection of Plane, Circularly and Elliptically Polarized Light.	do	01
	Phase Retardation Plates: Quarter-Wave and Half-Wave Plates.	do	01
	Analysis of Polarized Light	do	02
	Babinet Compensator and its Uses	Assignment	

Brewster's law and Reflection & Transmission coefficients.

- Total internal reflection and its conditions, evanescent waves.
- Reflection & Transmission coefficients for Metallic reflection (normal Incidence).

Activities

3. Preparation of assignment on particular topics;
4. Provided hand notes;
5. Discussions on Numerical based questions;

Points for the discussion:

- Discuss and plot the graph between E_{OT}/E_{OI} vs θ_I (incidence angle) and E_{OR}/E_{OI} vs θ_I (incidence angle) in case of perpendicular polarization of incidence wave, Fresnel's Formulae.
- Discuss and plot the graph between E_{OT}/E_{OI} vs θ_I (incidence angle) and E_{OR}/E_{OI} vs θ_I (incidence angle) in case of parallel polarization of incidence wave, Fresnel's Formulae.

References

3. Introduction to Electrodynamics, D.J. Griffiths, Benjamin Cummings.
4. Elements of Electromagnetic, M.N.O. Sadiku, Oxford University Press.

5. **Learning Outcomes**

After going through this unit, you will be able to:

Understand plane, Circular and elliptical polarized light.
Differentiate between isotropic and anisotropic medium and the EM wave propagation in anisotropic medium,
The symmetric nature of the dielectric nature,
Uniaxial and Biaxial Crystals and its properties like wave propagation in uniaxial crystals,

Double Refraction phenomenon and use of Nicol Prism for production of plane polarized light,
Production & detection of Plane, Circularly and Elliptically Polarized Light, use of Quarter-Wave and Half-Wave Plates.

Activities

4. Preparation of assignment on particular topics;
5. Provided hand notes;
6. Discussions on Numerical based questions;

Points for discussion:

3. Babinet Compensator and its Uses**.**

References

- Introduction to Electrodynamics, D.J. Griffiths, Benjamin Cummings.
- Elements of Electromagnetic, M.N.O. Sadiku, Oxford University Press

Unit	Topic	Method	No. of classes needed
IV	Optical Rotation, optical active substances, Calculation of angle of rotation and specific rotation.	Lecture and Discussion	02
	Fresnel's Theory of optical rotation, and its experimental verifications.	do	02
	Biot's Laws for Rotatory Polarization, Laurent's half-shade polarimeter	do	02
	Concept and Definitions of Numerical Aperture, Step and Graded Indices .Single and Multiple Mode Fibres	do	02
	Planar optical wave guides. Planar dielectric wave guide. Condition of continuity at interface. Phase shift on total reflection	do	02
	Eigenvalue equations. Phase and group velocity of guided waves. Field energy and Power transmission.	Assignment	

Learning outcomes

After going through this unit you should be able to:

12. Learn, optical Rotation, optical active substances, Calculation of angle of rotation and specific rotation.
13. Fresnel's Theory of optical rotation, and its experimental verification.

14. Concept and Definitions of Numerical Aperture, Step and Graded Indices .Single and Multiple Mode Fibers.
15. Planar optical wave guides. Planar dielectric wave guide. Condition of continuity at interface. Phase shift on total reflection.
16. Phase and group velocity of guided waves. Field energy and Power Transmission of wave guide;

Activities

4. Preparation of assignment on particular topics;
5. Provided hand notes;
6. Discussions on Numerical based questions;

Points for discussion

- Planar dielectric wave guide. Condition of continuity at interface.

References:

6. Introduction to Electrodynamics, D.J. Griffiths, Benjamin Cummings.
7. Elements of Electromagnetic, M.N.O. Sadiku, Oxford University Press
8. Text book of Optics, M. Subhrmanium, S. Chand New Delhi.
9. Electromagnetic waves and radiating system, E. C. Jordan, Pearson publications.