Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
B.Sc.	**Physics**	**I**	**PHYCC 111**	**Mechanics**	Mid Sem 40 End Sem 60	**04**

Course Objectives: To learn vector analysis and differential equations and their uses in Physics. To have knowledge about different types of motion, properties of matter. To learn relativity and relativistic motion.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: Will have idea about vector algebra and differential equations and their uses in Physics.

CO2: Will have knowledge about laws of motion and conservation laws.

CO3: Will have knowledge about rotational motion, gravitation, geosynchronous orbit, GPS.

CO4: Will be well acquainted with properties of matter like elasticity and viscosity.

CO5: Will be able to understand oscillatory motion and special theory of relativity.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1: Will have knowledge about vector algebra and differential equations and their uses in Physics.	Discussion on scalars, vectors, 1st order, 2nd order differential equations and their uses. Extended Q&A sessions. Use of black board for drawing diagrams, explanation and discussion.	Student presentation and group discussion. Objective type, short and long type questions.
2	CO2: Will have idea about laws of motion, conservation laws and central force. Use of black board for drawing diagrams, explanation and discussion. Extended Q&A sessions.	Discussion on Newton's laws of motion, central force, conservation laws, motion of rocket. Use of black board for drawing diagrams, explanation and discussion. Extended Q&A sessions.	Student presentation and group discussion. Objective type, short and long type questions.
3	CO3: Will learn about rotational motion, gravitation, satellite, geosynchronous orbit, GPS.	Discussion on rotational motion, gravitational motion. Use of black board for drawing diagrams, explanation and discussion. Extended Q&A sessions.	Student presentation and group discussion. Objective type, short and long type questions.
4	CO4: Will be well acquainted with properties of matter like elasticity and viscosity. Will learn about viscous flow of liquids.	Discussion on various properties of matter. Use of black board for drawing diagrams, explanation and discussion. Extended Q&A sessions.	Student presentation and group discussion. Objective type, short and long type questions.
5	CO5: Will learn about oscillatory motion and special theory of relativity.	Discussion on various oscillatory motion and special theory of relativity. Use of black board for drawing diagrams, explanation and discussion. Extended Q&A sessions.	Student presentation and group discussion. Objective type, short and long type questions.

Department of Physics						
Class	**Subject**	**Semester**	**CourseCode**	**Course Title**	**Marks**	**Credit**
B.Sc.	**Physics**	**I**	**PHY CC 112**	**Mechanics Lab**	**Mid Sem 40 End Sem 60**	**02**

Course Objectives:

To learn the use of basic instruments like vernier caliper, screw gauge and travelling microscope. To determine various properties of matter like rigidity, elasticity. T

Course Learning Outcomes:

Upon successful completion of the course, the student:

Will have idea about basic instruments like vernier caliper, screw gauge and travelling microscope and their practical use. Will learn about various properties of matter, can find out the value of g.

Objectives and Learning Outcomes of B.Sc. (Physics)

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
B.Sc.	**Physics**	**II**	**PHY-CC-211**	**ELECTRICITY AND MAGNETISM**	**100**	**04**

Course Objectives:

Students will learn the basic fundamental knowledge of Electricity and Magnetism which have vast applications in all area of science and technology. Students will be familiar with static electricity, current electricity, capacitor, Inductor, Dielectric materials, laws of magnetism and Maxwell's Equations.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: The students able to describe the fundamentals concepts of Vector Analysis. The details of scaler and vector potentials, Maxwell's equations and fields of charged particles in uniform motion. The vector integrals are the basic tool to understand the electrostatic and electromagnetic theory of waves.

CO2: This unit able to describe the various theorems of electrostatics and electric fields. The depth knowledge of electricity and magnetism. The basic fundamentals of capacitors, condensers and electric dipoles.

CO3: Students will get the knowledge about the dielectric and steady currents. They will also gain the deep knowledge about the LCR circuits polarizations, displacements vectors and analysis of multiloop circuits.

CO4: This unit able to describe the basic laws of currents and magnetism. Biot-Savart's law and its applications, Ampere's circuital laws and divergence and curl of magnetic field. Also explains the magnetic properties of materials. Some magnetic constants as magnetic induction permeability, magnetic susceptibility is elaborated in details.

CO5: The students able to describe the fundamentals of electromagnetic induction and waves theory. The details of Maxwell's equations and fields of charged particles in uniform motion. The Maxwell's equations are the basic tool to understand the electrostatic and electromagnetic theory of waves. The details of electromagnetic wave propagations through vacuum and isotropic dielectric medium as well as transverse nature of electromagnetic waves.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1:The students able to describe the fundamentals concepts of Vector Analysis. The details of scaler and vector potentials, Maxwell's equations and fields of charged particles in uniform motion. The vector integrals are the basic tool to understand the electrostatic and electromagnetic theory of waves.	Using black/white board for explaining the each and every mathematical formula and basic theory. Discussion with students is done as required. The display mode as Audio/Visual presentation is also exercised.	Unit test, group discussions and tutorials are exercised. The objectives, long or short type questions are done.
2	CO2: This unit able to describe the various theorems of electrostatics and electric fields. The depth knowledge of electricity and magnetism. The basic fundamentals of capacitors, condensers and electric dipoles.	Using white /black board for explaining the each and every concept, mathematical formula and basic theory. Also using the internet and multimedia to explain recent information regarding the topics.	Unit test, tutorials, objectives and long, short type questions exercised.

3	CO3:Students will get the knowledge about the dielectric and steady currents. They will also gain the deep knowledge about the LCR circuits polarizations, displacements vectors and analysis of multiloop circuits.	Through the internet and power point presentation as well as group discussions. Using white / black board for explanations.	Posters presentations, group discussions and objective type short and long answer questions.
4	CO4: This unit able to describe the basic laws of currents and magnetism. Biot-Savart's law and its applications, Ampere's circuital laws and divergence and curl of magnetic field. Also explains the magnetic properties of materials. Some magnetic constants as magnetic induction permeability, magnetic susceptibility is elaborated in details.	Using white / black board for explaining the each and every mathematical formula and basic theory. Also use multimedia for clarify the basic concepts.	By the student's poster presentations, groupdiscussions, and objective type short and long answer questions.
5	CO5: The students able to describe the fundamentals of electromagnetic induction and waves theory. The details of Maxwell's equations and fields of charged particles in uniform motion. The Maxwell's equations are the basic tool to understand the electrostatic and electromagnetic theory of waves. The details of electromagnetic wave propagations through vacuum and isotropic dielectric medium as well as transverse nature of electromagnetic waves.	Using board for explaining the each and every mathematical formula and basic theory. Also use short movies for explain the Faraday's laws of inductions, Lenz's Law and electromagnetic wave propagations.	By power point presentations and group discussions, objective type short and long answer questions. The regular seminar also asses the basic knowledge of the students.

Scheme of B.Sc. Program in Physics under CBCS System

Objectives and Learning Outcomes of B.Sc. (Physics)

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
B.Sc.	**Physics**	**III**	PHY CC 311	Thermal Physics and Statistical Mechanics	Mid Sem 40 End Sem 60	04

Course Objectives:

The objective of this course is to develop a working knowledge of laws and methods of thermodynamics and elementary statistical mechanics and to use this knowledge to explore various applications many of these applications related to physics of condensed matter.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: Will describe laws of thermal physics; zeroth law and first law of thermodynamics. Also applications of first law of thermodynamics to establish various thermodynamic relations are described in this unit.

CO2: Will explains reversible and irreversible process, entropy and second law of thermodynamics. This unit also defines efficiency of heat engine so that Carnot engine which is designed by applications of adiabatic and isothermal process.

CO3: Will explains thermodynamics potentials like Enthalpy, Gibbs, Helmholtz and Internal Energy functions. It also explains Maxwell's relations & applications to calculate Joule-Thompson Effect, Clausius- Clapeyron Equation, Expression for ($C_P - C_V$), C_P/C_V, TdS equations.

CO4: Will learn about basic concept of black body radiation and its explanation by Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Planck's law.

CO5: Will learn statistical mechanics which explains phase space, Microstate and Macrostate. This unit also explains Maxwell-Boltzmann law - distribution of velocity - Quantum statistics - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	AssessmentTasks*
1	First unit of this paper describe laws of thermal physics; zeroth law and first law of thermodynamics. Also applications of first law of thermodynamics to establish various thermodynamic relations are described in this unit.	In the classroom, power point presentation will be use to explain law of thermodynamics and its examples. White board will be use to derive equation of thermodynamics.	Student presentation and group discussion on the various physical process which are example of zeroth law.
2	Second unit of this paper explains reversible and irreversible process, entropy and second law of thermodynamics. This unit also defines efficiency of heat engine so that Carnot engine which is designed by applications of adiabatic and isothermal process.	In the classroom, power point presentation will be use to display examples of adiabatic process and isothermal process. White board will be use to derive expression for efficiency of engine and to solve numerical problems.	Student presentation and group discussion on examples of reversible and irreversible process. Q & A session will enhance the understanding.

3	This unit explains thermodynamics potentials like Enthalpy, Gibbs, Helmholtz and Internal Energy functions. It also explains Maxwell's relations & applications to calculate Joule-Thompson Effect, Clausius-Clapeyron Equation, Expression for ($C_P - C_V$), C_P/C_V, TdS equations.	In the classroom, power point presentation will be use to display examples of thermodynamic potentials. Q & A session will enhance the understanding.	Student presentation and group discussion on application of Joule-Thompson Effect and Clausius- Clapeyron Equation.
4	This unit will address basic concept of black body radiation and its explanation by Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Planck's law.	In the classroom, power point presentation will be use to explain spectra of black body radiation. White board will be use to derive various laws.	Student presentation and group discussion about limitations of law so that other law is required.
5	This unit is a part of statistical mechanics in which student will learn about phase space, Microstate and Macrostate. This unit also explain Maxwell-Boltzmann law - distribution of velocity - Quantum statistics - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics.	In the classroom, power point presentation will be use to explain and distinguish various statistical mechanics. White board will be use to derive various laws.	Student presentation and group discussion about statistics, identical particle and distinguish particles. Q & A session will be conducted to test understanding of students.

*Assessment tasks listed here are indicative, and may vary.

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
B.Sc.	**Physics**	**III**	PHY CC 312	Thermal Physics and Statistical Mechanics Lab	Mid Sem 40 End Sem 60	02

Course Objectives:

The objective of this course is to develop a working knowledge of laws and methods of thermodynamics and elementary statistical mechanics and to use this knowledge to explore various applications many of these applications related to physics of condensed matter.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: Will learn to calculate Mechanical Equivalent of Heat by Callender and Barne's constant flow method.

CO2: Will learn to calculate Planck's constant using black body radiation.

CO3: Will learn to calculate Stefan's Constant..

CO4: Will learn to do experiments to calculate thermal conductivity of conductor and bad conductor by Searle's Apparatus, Angstrom's Method and Lee and Charlton's disc method.

CO5: Will learn effect of temperature on resistant, electro-motive force, analysis of cooling as function of time and resistance temperature device will be studied and calculated by the students.

Facilitating the achievement of Course Learning Outcomes

Exp. No.	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks*
1	First experiment of this paper is to calculate Mechanical Equivalent of Heat by Callender and Barne's constant flow method.	Students will perform experiment and take observation to calculate Mechanical Equivalent of Heat.	Student will write complete experiment with their observation and calculation in their practical record.
2	In this experiment student will calculate Planck's constant using black body radiation.	Students will perform experiment and take observation to calculate Planck constant.	Student will write complete experiment with their observation and calculation in their practical record.
3	In this experiment student will calculate Stefan's Constant.	Students will perform experiment and take observation to calculate Stefan's constant.	Student will write complete experiment with their observation and calculation in their practical record.
4,5, 6	These experiments gives thermal conductivity of conductor and bad conductor by Searle's Apparatus, Angstrom's Method and Lee and Charlton's disc method.	Students will perform experiment and take observation to calculate thermal conductivity.	Student will write complete experiment with their observation and calculation in their practical record.
5, 6, 7, 8	The effect of temperature on resistant, electro-motive force, analysis of cooling as function of time and resistance temperature device will be studied and calculated by the students.	Students will perform experiment and take observation to calculate temperature-resistance-time and emfs.	Student will write complete experiment with their observation and calculation in their practical record.

Scheme of B.Sc. Program in Physics under CBCS System

Objectives and Learning Outcomes of B.Sc. (Physics)

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
B.Sc.	**Physics**	**III**	PHY SE 311	Electrical Circuits and Network Skills	Mid Sem 40 End Sem 60	02

Course Objectives:

The objective of the course is to enable the students to design and trouble shoots the electrical circuits networks and appliances through hands-on mode basic electricity principal: Voltage, current, resistance, and power ohms law, AC and DC electricity. Students will enable to design and trouble shoots the electrical circuits, networks and appliances through hands-on mode.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: This unit will describe voltage, current, resistance and power and its measurement by multimeter, voltmeter and ammeter. It also introduces relation between voltage and current by Ohm's law. Again in this unit student will learn about series, parallel, and series-parallel combinations.

CO2: In this unit student will learn about inductor, capacitor and relation between them. Student will also learn to calculate voltage drop across circuit elements. Again student will get knowledge of single-phase and three-phase alternating current sources.

CO3: In this unit student will learn principle and working of AC/DC generators. Again student will learn why step-up and step-down transformer would be used. In next part student will learn principle and working of Single-phase, three-phase & DC motors.

CO4: In this unit student will learn Electrical Protection devices as Relays, Fuses, disconnect switches, Circuit breakers, Overload devices, Ground-fault protection, Grounding and isolating, Phase reversal, Surge protection. Interfacing DC or AC sources to control elements (relay protection device)

CO5: In this unit student will learn about various types of electrical Wiring. The voltage drop and losses across cables and conductors calculation will also instruct to the students. Students get knowledge of devices which can be used to measure current, voltage, power in DC and AC circuits.

Facilitating the achievement of Course Learning Outcomes

Exp. No.	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks*
1	This unit will describe voltage, current, resistance and power and its measurement by multimeter, voltmeter and ammeter. It also introduces relation between voltage and current by Ohm's law. Again in this unit student will learn about series, parallel, and series-parallel combinations.	Voltmeter, ammeter and multi-meter uses will teach to the student. White board will be uses to establish equation for series and parallel combination of resistance.	Student presentation and group discussion on measurement devices and difference between them are consist in this unit.
2	In this unit student will learn about inductor, capacitor and relation between them. Student will also learn to calculate voltage drop across circuit elements. Again student will get knowledge of single-phase and three-phase alternating current sources.	Electrical circuit element will be demonstrated to the students.	Student presentation and group discussion on roll of different circuit elements. Student will also discuss ways to save energy and money.

3	In this unit student will learn principle and working of AC/DC generators. Again student will learn why step-up and step-down transformer would be used. In next part student will learn principle and working of Single-phase, three-phase & DC motors.	In the classroom, power point presentation will be use to display electricity generator and motor. White board will be use to write expression for voltage and current.	Student presentation and group discussion on uses of motor and generator.
4	In this unit student will learn Electrical Protection devices as Relays, Fuses, disconnect switches, Circuit breakers, Overload devices, Ground-fault protection, Grounding and isolating, Phase reversal, Surge protection. Interfacing DC or AC sources to control elements (relay protection device)	In the classroom, power point presentation will be use to display electrical protection devices. Some protection devices like Fuses, disconnect switches, Circuit breakers will be demonstrated in the classroom.	Student presentation and group discussion on roll and limitations of circuit elements.
5	In this unit student will learn about various types of electrical Wiring. The voltage drop and losses across cables and conductors calculation will also instruct to the students. Students get knowledge of devices which can be used to measure current, voltage, power in DC and AC circuits.	In the classroom, power point presentation will be use to demonstrate uses of electrical wiring on the basis of load.	Student presentation and group discussion on which type of cable in their home. What are their limitations. Q & A session will also be conducted

*Assessment tasks listed here are indicative, and may vary.

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
B.Sc.	**Physics**	**IV**	PHY CC 411	WAVES AND OPTICS	MID SEM 40 END SEM 60	**04**

Course Objectives: Objective of this course is to make students familiar with wave and optics. By the end of this course students shall know the basic laws of waves and oscillation and their application in research and technology. They will also be able to tell about the basic laws of light.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: Will be able to learn Linear and Superposition principle in Harmonic oscillations and understand to apply Graphical and analytical methods along with the applications of Lissajous figures

CO2: Will be learning about transverse, travelling and standing waves on a string, Group and phase velocity and other aspects of Sound waves like Simple harmonic motion Fourier's theorem, Intensity levels , musical notes etc.

CO3: Will be able to learn about the sound and interference of light. Here students will learn about the acoustics, reverberation, and Interference

CO4: Will be able to learn about the kind of fringes observed during the interference of light. It will also make students about the Michelson Interferometer.

CO5: Will have a good understanding of Diffraction and Polarization. In Diffraction they will learn about Fresnel and Fraunhofer diffraction. And in polarization they will study circular and elliptical polarization.

Facilitating the achievement of Course Learning Outcomes

Unit	**Course Learning Outcomes**	**Teaching and learning Activity**	**Assessment Tasks***
1.	Will be able to learn Linear and Superposition principle in Harmonic oscillations and understand to apply Graphical and analytical methods along with the applications of Lissajous figures	Audio-visual presentation as teaching aid for making students understand various topics like graphical and analytical methods and how they can use these techniques for solving problems	Students will be advised to find more applications of these techniques. Objective types, short answer type and long answer type questions.
2.	Will be learning about transverse, travelling and standing waves on a string, Group and phase velocity and other aspects of Sound waves like Simple harmonic motion Fourier's theorem, Intensity levels , musical notes etc.	Audio-visual presentation as teaching aid for understanding different things about sound. Use of white/ black board for drawing the complex diagram of saw tooth and square in simple form.	Students will be advised to find ways to these theorems in different problems. Objective types, short answer type and long answer type questions.

3.	CO3: Will be able to learn about the sound and interference of light. Here students will learn about the acoustics, reverberation, and Interference	Audio-visual presentation as teaching aid for understanding the various properties of Light and interference of it. During the classes students will be encouraged to discuss among themselves. They will be taught about the acoustics of sound and interference of light where they will understand the importance of Young's double slit experiment and Interference in Thin Films.	There are assignments assigned to different students for different topics and the discussion of those assignments in the class. Objective types, short answer type and log answer type questions
4.	CO4: Will be able to learn about the kind of fringes observed during the interference of light. It will also make students about the Michelson Interferometer.	Black/White board based teaching aid with notes about the Newton rings and michelson interferometer . They will be able to measure the refractive index and wavelength. Students shall also be able to determine the wavelength and wavelength difference from michelson interferometer	Students are encouraged to discuss the implication of interference and everyday examples of it and calculate the wavelengths of light. Objective types, short answer type and long answer type questions
5.	CO5: Will have a good understanding of Diffraction and Polarization. In Diffraction they will learn about Fresnel and Fraunhofer diffraction. And in polarization they will study circular and elliptical polarization.	Audio-visual presentation as teaching aid along with explanation by hand on Black/ White board about Fraunhofer diffraction,Single slit; Double Slit. Multiple slits & Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge as well. They will also be taught about polarization, which includes transverse nature of light waves. Plane polarized light production and analysis. Circular and elliptical polarization.	Students will be encouraged to find everyday examples of diffraction and polarization. Objective types, short answer type and long answer type questions.

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
B.Sc.	**Physics**	**IV**	PHY CC 412	WAVES AND OPTICS LAB	MID SEM 40 END SEM 60	**02**

Course Objectives: The main objective of this course is to introduce students with the evidence for the laws of wave optics. Students will also learn to confirm the wave nature of light through optics experiments.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO: Will be able to observe the law of wave optics through experiments like, investigating the motion of coupled oscillators, study Lissajous Figures, determine refractive index using sodium light and finding dispersive power using Mercury light. They will also be able to confirm the wave nature of light by performing experiments to determine wavelength of light using Newton's rings, Fresnel biprism and using diffraction of single slit which will also enable them to align the experiments, spectrometer and use Laser.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks*
1	Will be able to observe the law of wave optics through experiments like, investigating the motion of coupled oscillators, study Lissajous Figures, determine refractive index using sodium light and finding dispersive power using Mercury light. They will also be able to confirm the wave nature of light by performing experiments to determine wavelength of light using Newton's rings, Fresnel biprism and using diffraction of single slit which will also enable them to align the experiments, spectrometer and use Laser.	Presentation and black/white board will be used to explain these experiments to students. Live demonstrations will also be provided to them so they can understand the technicality of the experiments well.	Students will have to go through Viva and perform the assigned experiments. Short, Objective type questions

*Assessment tasks listed here are indicative, and may vary

Objectives and Learning Outcomes of M.Sc. (Physics)

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
B.Sc.	**Physics**	**V**	PHY SE 511	APPLIED OPTICS	MID SEM 40 END SEM 60	**02**

Course Objectives: Major objective of this paper is to instill students with the basic knowledge of LASER and optical fiber. By the end of this course they should be able to apply that knowledge in spectroscopy and holography. Since theory contains only qualitative studies, students will have to perform at least five experiments.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: Will be able to help students to understand the theory of Laser and its different properties as well as help them to learn different lasers such as He-Ne Laser and semiconducting Laser and their uses in daily life

CO2: Will be able gain knowledge about frequency filtering and Fourier transform of thin lens

CO3: Will be able to help students to understand the importance of Fourier transform spectroscopy in various applications such as NMR, remote sensing and forensic science

CO4: Will allow students to learn about Hologram and the application of holography in microscopy

CO5: Will be able to build the understanding about Optic fibres and how light propagates in an optic fibre. They shall also learn about single and multi mode fibres and attenuation in them.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1: Will be able to help students to understand the theory of Laser and its different properties as well as help them to learn different lasers such as He-Ne Laser and semiconducting Laser and their uses in daily life	Audio-visual presentation as teaching aid for understanding the various properties of LASER and its application. Use of white/ black board for drawing the complex diagram in simple form. During the teaching activity, there are group discussions between students. Students are taught about spontaneous and stimulated emissions. Along with this they will learn about Einstein's coefficients, amplification and different LASER like He-Ne and Semiconducting LASER.	There are assignments assigned to different students for different topics and the discussion of those assignments in the class. They will have to find the polarization angle of laser light using polarizer and analyzer Objective types, short answer type and log answer type questions

2	CO2: Will be able gain knowledge about frequency filtering and Fourier transform of thin lens	Black/White board based teaching aid with notes and drawing diagrams to show how Fourier transform is applied in a thin lens along with this practical examples are also given	Students will be advised to find more applications of these techniques. Objective types, short answer type and long answer type questions.
3	CO3: Will be able to help students to understand the importance of Fourier transform spectroscopy in various applications such as NMR, remote sensing and forensic science	Audio-visual presentation as teaching aid for understanding various applications of Fourier transform spectroscopy especially in major techniques such as atmospheric remote sensing, NMR spectrometry and forensic science. They are also taught about the importance of these techniques in modern research and technology	Students are encouraged to discuss and come up with their own ideas to use the technology. They will have to perform optical image addition and subtraction Objective types, short answer type and long answer type questions
4	CO4: Will allow students to learn about Hologram and the application of holography in microscopy	Black/ White board and audio visual presentation to gain knowledge about the theory and principle of holography. They will also learn about the different types of Holograms. They will also learn how holography is used in microscopy and the workings of white light reflection hologram.	Students are encouraged to read articles and watch videos of Holograms and their application. They shall be asked to record and reconstruct holograms. Objective types, short answer type and long answer type questions
5	CO5: Will be able to build the understanding about Optic fibres and how light propagates in an optic fibre. They shall also learn about single and multi mode fibres and attenuation in them.	Black/ white board teaching to make students learn about Optic fibres and their properties. Students will also learn how these optic fibres are used and what role does the unique propagation of light inside optic fibre plays in its application. Single and multi mode fibre and their importance will also be taught to the students. Attenuation limit of Optic fibre will be discussed among the students	Students will be asked to find out various fields where optic fibre is essential and required in day too day life. They shall be asked to perform and find out the numerical aperture of the optic fibre. Objective types, short answer type and long answer type questions

Objectives and Learning Outcomes of B.Sc. (Physics)

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
B.Sc.	**Physics**	**V**	**PHY EC 511**	**Digital and Analog Circuits And Instrumentation**	**Mid Sem 40 Ens Sem 60**	**04**

Course Objectives:
To have idea about the basics of electronics so that students can use the knowledge in electronics and electrical circuits.

Course Learning Outcomes:
Upon successful completion of the course, the student:
CO1: Will be able to learn about digital circuits, can differentiate between analog and digital circuits. Will be able to understand binary numbers and its use in digital circuits.
CO2: Will have idea about diodes and semiconductor devices based on diodes i.e. LEDS, Solar cells, photodiodes etc.
CO3: Will have idea about transistors and various types of amplifiers and their uses.
CO4: Will learn about CRO and its use in various electronic circuits.
CO5: Will learn about rectifiers, filters and their use. Will learn about voltage regulation in practical applications.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1: Will be able to learn about digital circuits, can differentiate between analog and digital circuits. Will be able to understand binary numbers and its use in digital circuits.	Discussion on analog and digital circits. Extended Q&A sessions. Use of black board for drawing circuit diagrams and explanation of operations of different circuits.	Student presentation and group discussion. Objective type, short and long questions.
2	CO2: Will have idea about diodes and semiconductor devices based on diodes i.e. LEDS, Solar cells, photodiodes etc.	Use of black board for drawing circuit diagrams and explanation and discussion. Extended Q&A sessions.	Student presentation and group discussion. Objective type, short and long questions.
3	CO3: Will have idea about transistors and various types of amplifiers and their uses.	Use of black board for drawing complex circuit diagrams and explanation. Extended Q&A sessions and discussion.	Student presentation and group discussion. Objective type, short and long questions.
4	CO4: Will learn about CRO and its use in various electronic circuits.	Black board teaching with notes and drawing diagrams to show important features of CRO. Extended Q&A session to involve each student in the class room.	Student presentation and group discussion. Objective type, short and long questions.

5	CO5: Will learn about rectifiers, filters and their use. Will learn about voltage regulation in practical applications.	Black board teaching with notes and drawing diagrams to show important features of rectifiers, filters and their use. Extended Q&A session to involve each student in the class room.	Student presentation and group discussion. Objective type, short and long questions.

Scheme of B.Sc. Program in Physics under CBCS System

Objectives and Learning Outcomes of B.Sc. (Physics)

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
B.Sc.	**Physics**	**V**	**PHY EC 512**	**Digital and Analog Circuits And Instrumentation Lab.**	**Mid Sem 40 End Sem 60**	**02**

Course Objectives:

To illustrate the students different analog and digital circuits and their application in practice. To impart knowledge on assessing performance of electronic circuit through monitoring of sensitive parameters.

Course Learning Outcomes:

Upon successful completion of the course, the student:

Will learn how to construct different types of GATES, transistor, diodes and study their characteristics and their practical applications in digital and analog circuits.

Scheme of B.Sc. Program in Physics under CBCS System

Objectives and Learning Outcomes of B.Sc. (Physics)

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
B.Sc.	**Physics**	**V**	**PHY EC 513**	**SOLID STATE PHYSICS**	**Mid Sem 40 Mid Sem 60**	**04**

1. **Course Objectives:** To describe the crystalline structures and diffraction techniques for crystal structure identification.
2. To describe to dynamics and different theoretical concepts related to specific heat.
3. To describe different properties like magnetic, dielectric and superconducting, semiconducting of solids.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: Will be able to learn general properties of solid, different phase of solid, crystal structure, lattice and their types after that X-ray diffraction techniques and how Bragg's law used in X-ray diffraction. Basic concepts like Brillouin Zones, closed pack structures etc.

CO2: Will get the knowledge about Lattice Vibrations in solid, types of lattice vibration like Linear Monoatomic and Diatomic Chains. They will also gain the knowledge about different laws used in lattice dynamics like Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids, T^3 law, etc.

CO3: Will get an in depth Knowledge about magnetic properties of matter, Quantum Mechanical Treatment of Par magnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic. They will also gain the knowledge about the Domains, B-H Curve and Hysteresis and Energy Loss.

CO4: Will understand the Dielectric Properties of Materials, Classical Theory of Electrical Polarizability, Normal and Anomalous Dispersion etc.

CO5: Will understand difference between the Conductors, Semiconductors and insulators. Types of Semiconductors and Hall Effect. They will also gain the knowledge about superconductors and types, London's Equation and Penetration Depth. Isotope effect etc.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	**CO1**: Will be able to learn general properties of solids, different phase, solid crystal Structures,lattice and their types, X-ray diffraction techniques and Bragg's law of X-ray diffraction. Brillouin Zones etc.	Audio-Video presentation aid showing the role and major contribution done by different crystal structures. Use of black board for crystal structure diagrams in simple form. The visualization of crystal structures with the help of models Q &A sessions.	Group discussion about available of crystal structures and related geometries, objectives, short and long questions.

2	**CO2**: Will get the knowledge about Lattice Vibrations, types of lattice vibration like Linear Monoatomic and Diatomic Chains. They will also gain the knowledge about different laws used in lattice dynamics like Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T^3 law	PPT for showing various vibrational images, Black board based teaching with notes and drawing diagrams, derive formulas etc. of lattice vibration like Linear Monoatomic and Diatomic Chains and discuss the laws used in lattice dynamics.	Objective type short and long questions, give assignments of problems.
3	**CO3**: Will get an in depth Knowledge about magnetic properties of matter, Quantum Mechanical Treatment of Para-magnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic. They will also gain the knowledge about the Domains, B-H Curve and Hysteresis and Energy Loss	Thought provoking questions and student involvement through their participation. Use of black board/ PPT for explanation of magnetic properties of matters, magnetic properties of materials through normal life examples.	Objective type short and long questions, show some magnetic properties based demonstrations in class etc.
4	**CO4**: Will understand Dielectric Properties of Materials: Polarization and Classical Theory of Electric Polariability. Normal and Anomalous Dispersion	The study of dielectric properties of materials, concern the storage and dissipation of electric and magnetic energy in material .The notes and lectures about the dielectric properties, short animation videos to learn the effect of dielectric properties and normal life examples, Q &A sessions about the topics.	Students Presentation and group discussion objective type, short and long questions.
5	**CO5**: Will understand difference between the Conductors, Semiconductors and insulators. Types of Semiconductors and Hall Effect. They will also gain the knowledge about superconductor and types of superconductor London's Equation and Penetration Depth. Isotope effect.	Use of internet, computer to show short animation videos to learn the effect of superconductors and types of superconductor. The student will take part in extended Q & A session during each topic	Poster and ppt presentation, objective type, short and long questions.

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
B.Sc.	**Physics**	**V**	**PHY EC 514**	**Solid State Physics Lab**	**Mid Sem 40 Mid Sem 60**	**02**

Course Objectives: This course will concentrate on the experimental determination of various common physical properties of the solid state materials, such as dielectric constant magnetic susceptibility, Piezoelectric coefficient, P~E and M~H hysteresis, resistivity, Hall coefficient, etc.

Course Learning Outcomes:

Upon successful completion of the course, the student:

- Will be able to have a sense of various physical properties
- Will be able to know the order of magnitudes, values and units of various types of material properties of solid state materials.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
	The students will be able to have a sense of various physical properties such as paramagnetic susceptibility of liquid and solid, Coupling Coefficient of a Piezoelectric crystal, Dielectric Constant Materials, complex dielectric constant, magnetic hysteresis, energy loss, resistivity of semiconductor, hall coefficient etc. The students calculate the values and units of various types of materials properties. They also able to correlate the theory read in theory papers and their practical importance through the instrumental operation. The lab course is provided to the student's hands on skills about instruments handling, operations and find out of results using theoretical concepts and formulae.	The solid state laboratory equipped with various lab modules such as Quinck`s susceptibility of paramagnetic solution, Magnetic susceptibility of Solids, Coupling Coefficient of a Piezoelectric crystal, Dielectric Constant of a dielectric Materials, complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR), Refractive index of a dielectric layer using SPR, PE Hysteresis loop of a Ferroelectric Crystal, BH curve of iron and energy loss calculation, resistivity of a semiconductor (Ge) crystal with temperature by four probe method determination of band gap, Hall coefficient of a semiconductor sample.	The marks will be awarded by the course coordinator after evaluation of each experiment based on the instrument handling, observations, calculations and representation of results of each experiment and given viva-voice periodically by students.

*Assessment tasks listed here are indicative, and may vary.

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
B.Sc.	**Physics**	**VI**	**PHY EC 614**	**Elements of Modern Physics**	**Mid Sem 40 End Sem 60**	**04**

Course Objectives:

Aim of this course is to get aware of basic principles of modern physics, wave and particle nature of light. To have knowledge about nucleus, radioactivity, fission, fusion etc.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: Student will learn about Photo-electric effect, Compton scattering, Davisson-Germer experiment to confirm the wave particle nature of light. Student will understand quantization rule and hydrogen atom spectra.

CO2: Will learn about wave-particle duality, Heisenberg's uncertainty principles to understand existence, non existence of various phenomena. Student will learn about Schrodinger equation the basic equation used in quantum mechanics to explain quantum systems, Operators, Wave function etc.

CO3: Will learn about one dimensional systems, their energy eigen values and energy wave function.

CO4: Will learn about basic properties of nucleus, nuclear force, binding energy.

CO5: Will have idea about radioactivity, fission, fusion, nuclear reactors.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1: Student will learn about Photo-electric effect, Compton scattering, Davisson-Germer experiment to confirm the wave particle nature of light. Student will understand quantization rule and hydrogen atom spectra.	Discussion on classical and quantum mechanics. Extended Q&A sessions. Use of black board for drawing diagrams, explanation and discussion.	Student presentation and group discussion. Objective type, short and long questions.
2	CO2: Will learn about wave-particle duality, Heisenberg's uncertainty principles to understand existence, non existence of various phenomena. Student will learn about Schrodinger equation the basic equation used in quantum mechanics to explain quantum systems, Operators, Wave function etc.	Use of black board for drawing diagrams, explanation and discussion. Extended Q&A sessions.	Student presentation and group discussion. Objective type, short and long questions.

3	CO3: Will learn about one dimensional systems, their energy eigen values and energy wave function.	Use of black board for explanation and discussion. Extended Q&A sessions about the topic.	Student presentation and group discussion. Objective type, short and long questions.
4	CO4: Will learn about basic properties of nucleus, nuclear force, binding energy.	Use of black board for drawing, explanation and discussion. Extended Q&A sessions about the subject.	Student presentation and group discussion. Objective type, short and long questions.
5	CO5: Will have idea about radioactivity, fission, fusion, nuclear reactors.	Use of black board for drawing of diagrams, elaborate explanation and discussion. Extended Q&A sessions about the subject.	Student presentation and group discussion. Objective type, short and long questions.

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
B.Sc.	**Physics**	**VI**	**PHY EC 615**	**ELEMENTS OF MODERN PHYSICS LAB**	**Mid Sem 40 End Sem 60**	**02**

Course Objectives: The aim of the course is to find out experimentally the value of various constants, specific charge etc used in theory. To have basic idea about diffraction, photoelectric effect.

Course Learning Outcomes:

Upon successful completion of the course, the student:

Can compare experimental and theoretical value of important constants used frequently in Physics like Planck's constant, Boltzmann constant, Rydberg constant. Will have practical idea about hydrogen spectra. Students will have knowledge about how diffraction pattern can be formed.