DEPARTMENT OF PHYSICS
DR. HARISINGH GOUR VISHWAVIDYALAYA, SAGAR

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

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**II**	**PHY CC 122**	**Classical Mechanics**	**Mid Sem 40 End Sem 60**	**04**

Course Objectives:
Students will be familiar with Newtonians mechanics and other form of mechanics based on principle of least action like Hamiltonian and Lagarangian mechanics. Students will learn four dimensional formulation, relativistic mechanics.

Course Learning Outcomes:
Upon successful completion of the course, the student:
CO1: Will learn conservation laws, constraints, Lagrange's equations which are the basics for further study.
CO2: Will be familiar with Lagarangian, Hamiltonian, which will be helpful for learning Quantum Mechanics.
CO3: Will be familiar with Canonical transformations, Poisson Bracket, Equation of motion which will be helpful for further study.
CO4: Will learn about small oscillation, Inertia tensor, rigid body which will be helpful to know about the motion of our galaxy, stars etc.
CO5: Will learn about relativistic mechanics, covariant four dimensional formulation, covariant Lagrangian, Hamiltonian.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1: Will learn conservation laws, constraints, Lagrange's equations which are the basics for further study.	Discussion on various types of mechanics. Extended Q&A sessions. Use of white board and ppt presentation for explanation and derivation.	Student presentation and group discussion. Objective type, short and long questions.
2	CO2: Will be familiar with Lagarangian, Hamiltonian, which will be helpful for learning Quantum Mechanics.	Use of white board and ppt presentation for discussion and derivation. Extended Q&A sessions.	Student presentation and group discussion. Objective type, short and long questions.
3	CO3: Will be familiar with Canonical transformations, Poisson Bracket, Equation of motion which will be helpful for further study.	Use of white board and ppt presentation for discussion and derivation. Extended Q&A sessions.	Student presentation and group discussion. Objective type, short and long questions. .
4	CO4: Will learn about small oscillation, Inertia tensor, rigid body which will be helpful to know about the motion of our galaxy, stars etc.	Use of white board and ppt presentation for discussion and derivation. Extended Q&A sessions.	Student presentation and group discussion. Objective type, short and long questions.

5	CO5: Will learn about relativistic mechanics, covariant four dimensional formulation, covariant Lagrangian, Hamiltonian.	Use of white board and ppt presentation for discussion and derivation. Extended Q&A sessions.	Student presentation and group discussion. Objective type, short and long questions.

Scheme of M.Sc. Program in Physics under CBCS System
Prof. Ashish Verma

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

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**I**	**PHY CC 123**	**Digital Electronics and Operational Amplifiers**	**Mid Sem 40 End Sem 60**	**4**

Course Objectives:

The major objective of this paper is to build a strong foundation in the Digital electronics, the importance of operational amplifiers in digital circuit. Its general properties and the economic importance in electronic devices.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: Will able to solve problems based on different number system such as Binary, octal and Hexa decimal number and their inter-conversion and basic knowledge of Logic gates, Adders, Multiplexer and Demultiplexer, Encoders and Decoders.

CO2: Will be able to understand the basic electronic equipment such as FLIP-FLOPS, Shift, Counters and combination of modular counters.

CO3: Will get depth knowledge about the Differential Amplifier: DC and AC analysis**,** CMRR Inverting and Non-inverting**,** Block Diagram of operational amplifier, Operational amplifiers with negative feedback.

CO4: Will get understanding about the Practical operational Amplifier: Input off set voltage, input offset current**,** output off voltage**,** Input Bias current and slew rate. Oscillator: Principle**,** Phase shift & Wein bridge**.**

CO5: Will understand the Basic comparator, fixed voltage regulator and Adjustable regulator. D/A Conversions: Binary weighted Resistors, R-2R ladder, A/D Conversions : Successive Approximation Resister method, Dual slope, and counter method etc.

Facilitating the achievement of Course Learning Outcomes

Unit	**Course Learning Outcomes**	**Teaching and learning Activity**	**Assessment Tasks**
1	CO1: Will able to solve problems based on different number system such as Binary, octal and Hexa decimal number and their inter-conversion and basic knowledge of Logic gates, Adders, Multiplexer and Demultiplexer, Encoders and Decoders.	Audio- visual presentation on different topics of CO1. Use of black/white board for drawing complex logic circuit and their simple solution. Discussion of different Multiplexer and Demultiplexer, Encoders and Decoders and their problems through detailed lecture and extended Q&A session	Student group discussion and Assignments on different topics of course. Objective type, short and long questions
2	CO2: Will be able to understand the basic electronic equipment such as FLIP-FLOPS, Shift, Counters and combination of modular counters.	Black/white board based teaching with notes and drawing diagrams to show important features of electronic equipments such as FLIP-FLOPS, Shift, Counters and combination of modular counters. Extended Q&A to involve each student in classroom.	Visual aid quiz for identification of type of FLIP-FLOPS. Objective type, short and long questions.

3	CO3: Will get depth knowledge about the Differential Amplifier: DC and AC analysis**,** CMRR Inverting and Non-inverting**,** Block Diagram of operational amplifier, Operational amplifiers with negative feedback.	Thought provoking questions and student involvement through their participation. Use of Black/white board for explanation. Audio-visual presentation as teaching aid to discuss the Operational amplifiers and their different properties.	Students group discussion, Objective type, short and long questions. .
4	CO4: Will get understanding about the Practical operational Amplifier: Input off set voltage, input offset current**,** output off voltage**,** Input Bias current and slew rate. Oscillator: Principle**,** Phase shift & Wein bridge**.**	The notes and lecture about the practical operational amplifier. Use of Black/white board for explanation. Audio-visual presentation as teaching aid to discuss about the oscillators and other topics.	Students group discussion, Assignments, Objective type, short and long questions.
5	CO5: Will understand the Basic comparator, fixed voltage regulator and Adjustable regulator. D/A Conversions : Binary weighted Resistors, R-2R ladder, A/D Conversions : Successive Approximation Resister method, Dual slope, and counter method etc.	Use of smart TV for different presentation based on different topics such as Basic comparator, Binary weighted Resistors, Dual slope, and counter method etc. The student will take part in extended Q&A session during and after each topic. Use of Black/white board for explanation.	Objective type, short and long questions.

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

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**1**	**PHYCC 124**	**Atomic, molecular and Laser Physics (Theory)**	**Mid Sem 40 End Sem 60**	**04**

Course Objectives: To increase the level of understanding of students about the various spectra of atoms, molecules and the use of electromagnetic radiation in understanding the tiny particles and the whole universe, they can enhance the understanding of interaction of light with matter which can be used to study various properties of different kinds of materials, This is also required for NET-CSIR, JEST, GATE and other national level examinations.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: will understand the spectrum of various kinds of atoms as well as the various models of atoms and the terminologies required to study them.

CO2: will understand about the splitting of the energy levels of atoms in presence of electric and magnetic fields and the selection rules governing transitions. Various spectrums of diatomic molecules and their selection rules.

CO3: will have in-depth knowledge about the molecular structure

CO4: will be able to answer about various spectroscopic techniques and their modern developments

CO5: will have deep knowledge about the fundamentals, principles of laser and knowledge of the various kinds of lasers,

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1: Students will gain knowledge about the spectrum of 1 electron and many electron atoms; various important quantum-mechanical models to study the electronic structure of many electron systems; Spectroscopic terms which represent the states.	Audio-visual presentation as teaching aid to impart the better understanding of electronic structures of atoms among students; Use of white board for simplifying the complex diagrams. Discussion with students for better understanding of the topics.	Student presentation with the corresponding queries and discussions on the spectrum and models of the various systems.
2	CO2: Students will have an intuitive understanding about the outcomes of the interactions of the electromagnetic radiation with the various atoms and the molecules and the rules governing this process. They will learn about the rotational, vibrational, electronic,	Thought provoking questioning and answering activity which will lead students to the intuitive understanding of the rules and outcomes when electromagnetic field interact with the systems.	Student presentation via electronic means or the conventional chalk-board means; Group discussions; Work-out assignments for home-work on the topics discussed in the class.

	Raman and infrared spectrums arising due to this interaction,		
3	CO3: Students will gain in-depth knowledge about the molecular structure using various concepts.	white board based teaching with notes and drawing diagrams. Extended Q&A to involve each student in the classroom. Use of audio-visual presentation to aid the teaching.	Poster and ppt presentations; Group discussion, objective-type questions
4	CO4: Students will have an exposure to various spectroscopic techniques (Infrared, Raman, NMR, ESR and Mossbauer spectroscopy) and further modern developments in them.	Use of the internet, electronic devices to get the clear visualization and understanding of the instrumentation, principle and working of the various spectroscopic techniques. Use of white board for derivation and drawing of diagrams.	PPT presentations can be assigned to each student to enhance teaching-learning experience.
5	CO5: Students will be able to answer about the fundamentals and the principles of lasers. Also, they will learn about various types of lasers developed with time.	Use of white board for derivation and drawing of diagrams.Use of the presentations of the various lasers and the mechanisms involved in them. Students will take part in the extended Q and A sessions during and after each topic.	Poster and ppt presentations, objective type short and long questions.

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

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

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

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**I**	PHY CC 125	Laboratory Course	MID SEM 40 END SEM 60	**02**

Course Objectives: Major objective of this paper is to instill students with the basic knowledge of Solid state practicals and make students aware of properties of LASER, optical Fiber, resistivity, Band gap of materials, Hall effect etc.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO : Will become aware with properties of Optical fibre and how the light propagate through it along with their application. Students will also learn about LASER and its different types, and how different LASERs are used in different walks of life.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks*
1	Will become aware with properties of Optical fiber and how the light propagate through it along with their application. Students will also learn about LASER and its different types, and how different LASERs are used in different walks of life	Presentation and black/white board will be used to teach students about experiments about Solid state materials. Live demonstrations will also be provided to them so they can understand the technicality of the experiments well. Students will learn to determine diameter of laser beam, Hall coefficient, wavelength of He-Ne Laser, resistivity of semiconductor, Curie temperature etc.	Students will perform the assigned experiments. Viva voce, Presentation, Short, Objective type questions

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**I**	**PHY CC 126**	**Laboratory course II (Electronics –I)**	**Mid Sem 40 End Sem 60**	**02**

Course Objectives: To understand the concept of basic and universal Gates. To have basic idea about flip flop, timer, digital to analog converter, OPAMP, Power supply.

Course Learning Outcomes:
Upon successful completion of the course, the student:
Will learn how to construct basic gates with the help of universal gates, will have idea about the characteristics of various Gates, their practical use. Student will have understanding about circuits and operation of flip flop, timer, converter, OPAMP, power supply and their use in practical applications.

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**I**	PHY SE 121	Seminar	MID SEM 40 END SEM 60	**02**

Course Objectives: Main objective of this course is to give students exposure and make them courageous facing questions from the audience. They will learn to express their views in scientific vernacular and present themselves in an understandable manner.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO : Will be able to present themselves in front of an audience. It will help them to develop skills like speaking ability, gain and express knowledge in different fields and presentation capability. They will also learn to defend themselves in front of a panel of Seminar Committee.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks*
1	Will be able to present themselves in front of an audience. It will help them to develop skills like speaking ability, gain and express knowledge in different fields and presentation capability. They will also learn to defend themselves in front of a panel of Seminar Committee.	Students will be encouraged to explore different topics and express themselves in a coherent manner. They will be persuaded to be curious and survey various aspects of Physical nature.	Presentation and a thorough questioning and cross examination by the Seminar Committee

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

Dr. Anupama Chanda

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**II**	**PHYCC221**	**Quantum Mechanics**		

Course Objectives:

This course primarily aims to provide the basic concepts of quantum mechanics and various formalism of quantum mechanics with simple examples. The angular momentum and spin dynamics of the quantum systems will be discussed. Some standard approximation techniques such as time independent perturbation, Variational method and WKB approximation for solving quantum static systems will be discussed.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: Will be able to understand the basic concepts and principles of quantum mechanics and its applications to simple systems like simple harmonic oscillator.

CO2: Will be able to understand angular momentum and spin dynamics of quantum systems. Will be able to solve angular momentum using CG coefficients.

CO3: Will be able to distinguish odd half and integral spin particles. Can understand the symmetric and antisymmetric particles.

CO4: Will be able to find the energy and wave functions of quantum conservative systems.

CO5: Will understand various approximation techniques and solve simple systems.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1: Will be able to understand the basic concepts and principles of quantum mechanics and its applications to simple systems like simple harmonic oscillator.	Discussion on various concepts and formalism of quantum mechanics and extended Q&A sessions. Use of white board for figure and derivation.	Student presentation and group discussion. Objective type, short and long questions.
2	CO2: Will be able to understand angular momentum and spin dynamics of quantum systems. Will be able to solve angular momentum using CG coefficients.	Use of white board for explanation and derivation of angular momentm and spin components using CG coefficients. Extended Q&A session to involve each student in the classroom.	Student presentation and group discussion. Objective type, short and long questions.
3	CO3: Will be able to distinguish odd half and integral spin particles. Will understand the symmetric and antisymmetric particles.	Thought type questions and student involvement through their participation. Use of white board for explanation and derivation.	Student presentation and group discussion. Objective type, short and long questions.
4	CO4: Will be able to find the energy and wave functions of quantum conservative systems.	Elaborate explanation and discussion of basic concepts of approximation methods using white board. Extended Q&A session about the topic to involve each student.	Student presentation and group discussion. Objective type, short and long questions.

5	CO5: Will understand various approximation techniques and solve simple systems.	Discussion and explanation of simple systems like ground state of He-atom, hydrogen molecular ion and deuteron using white board. Extended Q&A session about the topic to involve each student.	Student presentation and group discussion. Objective type, short and long questions.

Course Teacher: Dr. Poornima Varma

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**II**	**PHY-CC-222**	**Electrodynamics and Plasma Physics**	**100**	**04**

Course Objectives:

The most important objects of this paper are to study the fundamental facts about the electrodynamics and plasma physics. The present era is digital era so the basic knowledge about the fundamentals is more essentials. The course is elaborated many facts, general properties and state-of-art of the subject.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1:The students able to describe the fundamentals of classical electrodynamics and quantum mechanics. The details of scaler and vector potentials, Maxwell's equations and fields of charged particles in uniform motion. The Maxwell's equations are the basic tool to under stand the electrostatic and electromagnetic theory of waves.

CO2: In this unit the extended study of Maxwell's equations is able to understand the fields study, particle velocity, review of four vectors and Lorentz transformation in 4-dimension spaces. This will give the depth knowledge about the invariance of electric charge.

CO3: Students will get the knowledge about the electromagnetic field's tensors in 4-dimensional Maxwellian equations. They will also gain the deep knowledge about the Lorentz transformation, Langragian and Hamiltonian transformations which are able to explain the motion of charged particles in Electro Magnetic fields.

CO4: Students can understand the basic concept of plasma physics and theory of astrophysical plasma as well as space plasma. Present era is digital and satellite era so the deep knowledge about the transient phenomena occur in space is too much essential to know every student. This unit provide the deep understanding about the space, astrophysics and plasma physics.

CO5: Will get working knowledge of electromagnetism using the tools of magnetohydrodynamics and plasma physics. To improved the skill of solving mathematical problems related to magnetohydrodynamics concepts.

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 of classical electrodynamics and quantum mechanics. The details of scaler and vector potentials, 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.	Using white /black 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 and group discussions on the role of fundamental electrodynamics, tutorials, objectives and long or short type questions are done.
2	CO2: Unit extended study of Maxwell's equations is able to understand the fields study, particle velocity, review of four vectors and Lorentz transformation in 4-dimension spaces. This will give the depth knowledge about the invariance of electric charge.	Using white /black board for explaining the each and every mathematical formula and basic theory. Use of internet and multimedia to explain recent information regarding the topics.	Tutorials, objectives and long or short type questions are done. Unit test is also exercised.

3	CO3: Students will get the knowledge about the electromagnetic field's tensors in 4-dimensional Maxwellian equations. They will also gain the deep knowledge about the Lorentz transformation, Langragian and Hamiltonian transformations which are able to explain the motion of charged particles in Electro Magnetic fields.	Through the internet and power point presentation as well as group discussions.	Student presentations and group discussions, objective type short and long answer questions.
4	CO4:Students can understand the basic concept of plasma physics and theory of astrophysical plasma as well as space plasma. Present era is digital and satellite era so the deep knowledge about the transient phenomena occur in space is too much essential to know every student. This unit provide the deep understanding about the space, astrophysics and plasma physics.	Using white /black board for explaining the each and every mathematical formula and basic theory. Also use short movies of galaxies and space regions where many transients' phenomena occur.	By the student'sposter presentations and group discussions, objective type short and long answer questions.
5	CO5: Will get working knowledge of electro-magnetism using the tools of magneto-hydrodynamics and plasma physics. To improve the skill of solving mathematical problems related to magneto hydrodynamics concepts.	Using board for explaining the each and every mathematical formula and basic theory. Also use short movies of galaxies and space regions where many transients' phenomena occur.	By the student's power point presentations and group discussions, objective type short and long answer questions. The seminar also asses the basic knowledge of the students.

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

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**2**	PHY CC 223	**Electronic Devices**	**MID SEM 40 END SEM 60**	**04**

Course Objectives: The major objective of this paper is to develop a strong foundation in the field of Electronic devices. It provides an insight to the knowledge of essential electronic devices like transistors, microprocessors, microcontrollers, photonic devices, sensor and transducers. This course will ddemonstrate proficiency in the use of electronic equipment and devices solve electronic devices and systems.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1:It will help students know about various types of transistors and their applications.

CO2: It will help students know different applications of photonic devices in day-to-day life

CO3:It will develop research aptitude in students towards electronics by discussing the advances in computer technology and semiconductor memories

CO4:Students will be able to know how semiconductors can be fabricated to form new electronic devices. They will come to know how transducers were introduced and what are their applications

CO5:Students will learn the evolution in the field of electronics over time. They will also know about different types of filters and their applications

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1: It will help students know about various types of transistors and their applications.	During the teaching activity, there are group discussions between students. The queries regarding the proficiency in the use of electronic devices could be resolved using this. Students are taught about BJTs, FETs, in detail with block diagrams. Also, Construction of transistor, transistor biasing in active region, transistor operation in active region, construction of JFET, Biased JFET, JFET characteristics, Depletion and Enhancement type MOSFET, MOSFET, bsics of microprocessor and	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

		Microcontroller are taught	
2	CO2: It will help students know different applications of photonic devices in day-to-day life	During the class hours, practical examples are told to the students, so that they can connect the things written in the book with their daily life. Specially, how the photonic devices affect human lives.Students are taught about Light dependent resistor (LDR), diode photo detectors, Solar cell (I-V characteristics, Spectral esponse, fill factor), LED, diode lasers.	Students are asked to seek different applications of electronic devices which they find in their daily life. Objective types, short answer type and long answer type questions
3	CO3:It will develop research aptitude in students towards electronics by discussing the advances in computer technology and semiconductor memories	During the class, the teachers tell about the necissity of these studies and their applications in the research. Also there are discussions about latest research in the field. Students are taught about the computer technologies, and memory management.Students get to learn abourt Memory organization, Expanding memory size, classification of memories. ROM and RAM chip. Charged compiled device (CCD) memory, content addressable memory.	Students are asked to go through latest research papers in the field, and discuss in the class. Objective types, short answer type and long answer type questions.
4	CO4:Students will be able to know how semiconductors can be fabricated to form new electronic devices. They will come to know how transducers were introduced and what are their applications	Classes describe how semiconductors are fabricated to form various electronic devices which find applications in different fields.The various fabrication methods and the application and performance of the fabricated electronic devices are discussed in the class. Students are told about transducer and its uses.Temperature, pressure and vibration. Measurement and control, signal conditioning system AC and DC, instrumentation amplifier. Lock in amplifier are the topics, discussed in the class.	Students are asked to go through various videos depicting fabrication of electronic devices. Objective types, short answer type and long answer type questions.

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

Department of Physics						
Class	**Subject**	**Semester**	**CourseCode**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**II**	**PHY CC 224**	**Condensed Matter Physics**	**Mid Sem 40 End Sem 60**	**04**

Course Objectives:

The students will learn about various crystal systems and related properties, theory of band formation, properties of matter like lattice vibrations, magnetic, dielectric, semiconducting, and super-conducting etc. They also get familiar with structural, electrical, thermal and optical properties of matter

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: Will be able to describe the properties of crystal structure like Symmetry of crystal, crystal system, Bravais lattice, the concept of point group, space group, Miller indices, Unit cell, Wigner-Seitz unit, reciprocal lattice, closed packed structure, (BCC, FCC, HCP, DC) coordination number & coordination geometry this concept help to differentiate the different type of crystal structure. Also, they will gain about the characteristic of crystals using the principle of powder diffraction method; Elementary idea about interpretation of power XRD Types of Crystal binding: Ionic, Covalent, Metallic, Vander walls bonding.

CO2: Will get knowledge about the Free electron theory of metals. Hall Effect, Elementary ideas of quantum Hall effect, Thermal and transport properties. Thermal conductivity in metals. Vibration in solid, normal modes, phonons, normal and unklopb processes, Mobility of charge carriers and Seeback coefficient, Wiedmann Franz law. Electronics-specific heat. Bloch functions. Nearly free electron approximation. Also, they will gain the Formation of energy bands, gaps at Brillouin zone boundaries, Effective mass, and the concept of holes. Fermi surface.

CO3: Will get knowledge about the Superconductivity of materials because Superconductivity is the ability of certain materials to conduct electric current with practically zero resistance. They will survey of important experimental result; critical temperature, persistent current, Meissner effect; the Basic idea of BCS theory, Type I and Type II superconductor super conducting Materials, and their application. High Tc superconductivity.

CO4: Will get the knowledge about the Dielectric properties of solids. Before understanding the dielectric properties of solids, we need to have a clear understanding of what dielectric materials are and their characteristics. So, first, we discussed dielectric materials in brief before explaining of dielectric properties of solids. Also describe Complex dielectric and dielectric losses, relaxation time, and Debye equation for orientational polarizability; theory of electronic and ionic polarization, Ferroelectricity-dipole theory, classifications of ferroelectric material

CO5: Will get the knowledge about the Diamagnetic susceptibility. Quantum theory of paramagnetism. Transition metal ions and rare earth ions in solids. Crystal field effect and orbital quenching. Ferromagnetic and antiferromagnetic ordering. Curie-Weiss theory, Heisenberg theory, Curie and Neel temperatures.

Optical properties of solids: band to band absorption, excitions. Polarons, Colour centres. Luminescence. Photoconductivity.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1: Will be able to describe the properties of crystal structure like Symmetry of crystal, crystal system, Bravais lattice, the concept of point group, space group, Miller indices, Unit cell, Wigner-Seitz unit, reciprocal lattice, closed packed structure, (BCC, FCC, HCP, DC) coordination number & coordination geometry this concept help to differentiate the different type of crystal structure. Also, they will gain about the characteristic of crystals using the principle of powder diffraction method; Elementary idea about interpretation of power XRD Types of Crystal binding: Ionic, Covalent, Metallic, Vander walls bonding	PPT, Models, white board-based teaching with notes and drawing diagrams to show the crystal structure like FCC, BCC, SC, etc.Use of audio-visual presentation to aid the teaching.	Student discussion on the various crystal structures. Objective-type questions. Short and long questions.
2	CO2: Will get knowledge about the Free electron theory of metals. Hall Effect, Elementary ideas of quantum Hall effect, Thermal and transport properties. Thermal conductivity in metals. Vibration in solid, normal modes, phonons, normal and unklopb processes, Mobility of charge carriers and Seeback coefficient, Wiedmann Franz law. Electronics-specific heat. Bloch functions. Nearly free electron approximation. Also, they will gain the Formation of energy bands, gaps at Brillouin zone boundaries, Effective mass, and the concept of holes. Fermi surface	White board-based teaching with notes and drawing diagrams to show the theory of Free electron theory of metals. Hall Effect, Elementary ideas of quantum Hall effect, Fermi surface, etc.Use of audio-visual presentation to provide better understanding	Student group discussion on the various theory. Objective-type questions. Short and long questions.
3	CO3: Will get knowledge about the Superconductivity of materials because Superconductivity is the ability of certain materials to conduct electric current with practically zero resistance. They will survey of important experimental result; critical temperature, persistent current, Meissner effect; the Basic idea of BCS theory, Type I and Type II superconductor super conducting Materials, and their application. High Tc superconductivity.	Black/White board-based teaching with notes and drawing diagrams to show the theory of Supercondutivityand releted their properties.Use of audio-visual presentation to aid the teaching	Student group discussion on the various theory. Objective-type questions. Short and long questions. .

4	CO4: Will get the knowledge about the Dielectric properties of solids. Before understanding the dielectric properties of solids, we need to have a clear understanding of what dielectric materials are and their characteristics. So, first, we discussed dielectric materials in brief before explaining of dielectric properties of solids. Also describe Complex dielectric and dielectric losses, relaxation time, and Debye equation for orientational polarizability; theory of electronic and ionic polarization, Ferroelectricity-dipole theory, classifications of ferroelectric materials	Black/White board-based teaching with notes and drawing diagrams to show the theory of dielectric materials.Use of audio-visual presentation to aid the teaching	Student presentation and group discussion on the various theory. Objective-type questions. Short and long questions.
5	CO5: Will get the knowledge about the Diamagnetic susceptibility. Quantum theory of paramagnetism. Transition metal ions and rare-earth ions in solids. Crystal field effect and orbital quenching. Ferromagnetic and antiferromagnetic ordering. Curie-Weiss theory, Heisenberg theory, Curie and Neel temperatures. Optical properties of solids: band to band absorption, excitions. Polarons, Colour centres. Luminescence. Photoconductivity	Black/White board-based teaching with notes and drawing diagrams to show the properties of theory of Diamagnetic susceptibility. Quantum theory of paramagnetism. Transition metal ions and rare earth ions in solids. Crystal field effect and orbital quenching. Ferromagnetic and antiferromagnetic ordering. Curie-Weiss theory, Heisenberg theory, Curie and Neel temperatures. Optical properties of solids: band to band absorption, excitions. Polarons, Colour centres. Luminescence.	Student group discussion on the various theory. Objective-type questions. Short and long questions.

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

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

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

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**I**	PHY CC 225	Laboratory Course	MID SEM 40 END SEM 60	**02**

Course Objectives: Major objective of this paper is to instill students with the basic knowledge of Solid state practicals and make students aware of Fourier's analysis, Qurie Temperature , Temperature dependant, Hall effect, Electron spin resonance etc.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO : Will become aware with ESR apparatus find the G factor Students will also learn about Curie Temperature of Ferro magnetic material and find the even and odd harmonics of wave from Fourier analysis Kit .

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks*
1	Will become aware with even, odd harmonics of sine square wave with their application. Students will also learn about G factor by the ESR apparatus and find the effect of curie temperature on Ferro magnetic materials	Presentation and black/white board will be used to teach students about experiments about Solid state materials. Live demonstrations will also be provided to them so they can understand the technicality of the experiments well. Students will learn to determine diameter of laser beam, Hall coefficient, wavelength of He-Ne Laser, resistivity of semiconductor, Curie temperature etc.	Students will perform the assigned experiments. Viva voce, Presentation, Short, Objective type questions

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

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**II**	**PHYC C 226**	**Laboratory course IV (Electronics –II)**		

Course Objectives:

To know the concept of RC coupled amplifier, FETs, MOSFETs. Filters and Oscillator.

Course Learning Outcomes:

Upon successful completion of the course, the student:

Will learn how to construct the circuits of RC coupled amplifier, FETS, MOSFETS, Filters, Oscillators and their characteristics, frequency response.

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**II**	**PHY SE 221**	**Seminar**	**Mid Sem 40 Mid Sem 60**	**02**

Course Objectives: *Objective of the seminar is to get student present themselves in front of audience and keep their views.*

Course Learning Outcomes:

The course every student compulsorily delivered a seminar of approximately 30 minutes duration on a topic as decided by the Departmental Seminar Committee.

Upon successful completion of the course, the student:

- Will be able to represent himself/herself in front of the audience.
- Will be able to learn how to defend the questions of audience?
- Will be able to learn the importance of the suggestions of audience.
- Will be able to developed better communication skill.
- Will be able to achieve higher level of confidence.
- Students will be ready for the future interviews.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
	The students will be able to represent himself/herself in front of the audience. They will be able to learn how to defend the questions of audience and importance of their suggestions. They will be developed better communication skill and achieved higher level of confidence. The course will be ready our students for the future interviews.	Audio-visual presentation (power point presentation) used as seminar presentation tool. They may use white board for descriptions, derivations and explanations etc.	The marks will be awarded by the Seminar Committee on the basis of presentation style, Presented topic and discussion with audience

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

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

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**II**	**PHY OE 221**	**Energy and environment**	**Mid Sem 40 End Sem 60**	**02**

Course Objectives:

The aim of this course is to introduce students about various renewable and non-renewable energy sources and their conservation. It also provides information about energy storage devices. This course also brings attention of students about environmental issues and control process.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: will understand basic idea about energy and its measurement. They will learn importance of energy in our daily life and hence they feel the necessity of planned and managed energy consumption. Along with they will also learn different aspects and challenges about conventional energy sources.

CO2: will learn about some non-conventional energy sources like wind energy, solar energy, hydro energy etc. Furthermore, they will learn working and basic principle of Fuel cell and Nuclear Fusion Reactor.

CO3: will learn about different types of methods to store energy and energy storage devices. Efficient energy storage is one of the most important aspects of this syllabus that will be discussed in this unit.

CO4: will direct to understand importance and need of energy conservation in industry, transport, households, buildings, agriculture, lighting. Students will learn how to reduce energy wastages in thermal and electrical system utilities.

CO5: will address environmental aspects of energy production and utilization. Students will learn how energy production causes different types of pollution like air, water, soil, noise etc. Including this they will learn how to control and limit the cause of pollution arising due to the energy production.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1: By this unit students will understand basic idea about energy and its measurement. They will learn importance of energy in our daily life and hence they feel the necessity of planned and managed energy consumption. Along with they will also learn different aspects and challenges about conventional energy sources.	In the classroom, power point presentation will be use to show different types of conventional energy sources. White board will be use to address some of the thought arise during the lecture. Q & A session will enhance the understanding about the energy sources.	Student presentation and group discussion on the roll of important conventional energy sources.

2	CO2: By this unit students will learn about some non-conventional energy sources like wind energy, solar energy, hydro energy etc. Furthermore, they will learn working and basic principle of Fuel cell and Nuclear Fusion Reactor.	In the classroom, power point presentation will be use to show different types of non-conventional energy sources. White board will be use to address some of the thought arise during the lecture.	Student presentation and group discussion on the roll of non-conventional energy sources.
3	CO3: This unit will direct student to understand importance and need of energy conservation in industry, transport, households, buildings, agriculture, lighting. Students will learn how to reduce energy wastages in thermal and electrical system utilities.	In the classroom, power point presentation will be use to describe conservation of energy. White board will be use to address some of the thought arise during the lecture.	Quiz for identify how much students know about the conservation of energy.
4	CO4: Efficient energy storage is one of the most important aspects of this syllabus that will be discussed in this unit. Students will learn about different types of methods to store energy and energy storage devices.	In the classroom, power point presentation will be use to show different methods to store energy and different energy storage devices. White board will be use to address some of the thought arise during the lecture.	Representation of some of the batteries as energy storing device and experimental working demonstration of them.

DEPARTMENT OF PHYSICS
DR. HARISINGH GOUR VISHWAVIDYALAYA, SAGAR

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

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**II**	**PHY CC 321**	**Statistical Mechanics**	**Mid Sem 40 End Sem 60**	**04**

Course Objectives:

Students will have a broad understanding of the behavior of various thermodyamanic/statistical/many body physical systems. The various types of statistics in dealing with different statistical systems and their associated physical phenomena will empower the students for overall conclusive understanding about their behaviors/physical properties they used to show.

Course Learning Outcomes:

Upon successful completion of the course, the following course out comes will arise.:

CO1:The basics of statistical mechanics along with their relation to thermodynamic parameters and various basic laws such as Maxwells distribution of molecular velocities and Gibb's paradox will be discussed elaborately.

CO2:Students will be familiar with the phenomenon of phase transitions for thermodynamic systems and their types along with their practical applications and critical analysis.

CO3:The mathematical approach of various types of statistics such MB, FD and BE for applying to various types of physical systems will be discussed.

CO4:The various practical physical phenomenon, such as Black body radiation, BE condensation, heat capacity of solids, Pauli paramagnetism and density of state along with the concept of Fermi energy will be explored, by applying the FD and BE statistics.

CO5:The cooperative phenomenon in a collection of spins will be explained with the help of 1D Ising model. Some of the non-equilibrium physical phenomenon will also form the part of the syllabus.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1:The basics of statistical mechanics along with their relation to thermodynamic parameters and various basic laws such as Maxwells distribution of molecular velocities and Gibb's paradox will be discussed elaborately.	Doing various types of class room activities for better understanding. Extended Q & A sessions. Use of white board and PPT presentation for better explanation of the concepts and their detailed mathematical derivations. Making the task of presentations from the students also.	Student participation and activeness in answering the questions during class hours. Group discussions, MCQ, Objective, short answer type questions based on basic concepts and problem solving skills. Long answer type questions based on the course curriculum for determining the scientific temperament.
2	CO2:Students will be familiar with the phenomenon of phase transitions for thermodynamic systems and their types along with their practical applications and critical analysis.	Doing various types of class room activities for better understanding. Extended Q & A sessions. Use of white board and PPT presentation for better explanation of the concepts and their detailed mathematical	Student participation and activeness in answering the questions during class hours. Group discussions, MCQ, Objective, short answer type questions

		derivations. Making the task of presentations from the students also.	based on basic concepts and problem solving skills. Long answer type questions based on the course curriculum for determining the scientific temperament.
3	CO3:The mathematical approach of various types of statistics such MB, FD and BE for applying to various types of physical systems will be discussed.	Doing various types of class room activities for better understanding. Extended Q & A sessions. Use of white board and PPT presentation for better explanation of the concepts and their detailed mathematical derivations. Making the task of presentations from the students also.	Student participation and activeness in answering the questions during class hours. Group discussions, MCQ, Objective, short answer type questions based on basic concepts and problem solving skills. Long answer type questions based on the course curriculum for determining the scientific temperament.
4	CO4:The various practical physical phenomenon, such as Black body radiation, BE condensation, heat capacity of solids, Pauli paramagnetism and density of state along with the concept of Fermi energy will be explored, by applying the FD and BE statistics	Doing various types of class room activities for better understanding. Extended Q & A sessions. Use of white board and PPT presentation for better explanation of the concepts and their detailed mathematical derivations. Making the task of presentations from the students also.	Student participation and activeness in answering the questions during class hours. Group discussions, MCQ, Objective, short answer type questions based on basic concepts and problem solving skills. Long answer type questions based on the course curriculum for determining the scientific temperament.
5	CO5:The cooperative phenomenon in a collection of spins will be explained with the help of 1D Ising model. Some of the non-equilibrium physical phenomenon will also form the part of the syllabus.	Doing various types of class room activities for better understanding. Extended Q & A sessions. Use of white board and PPT presentation for better explanation of the concepts and their detailed mathematical derivations. Making the task of presentations from the students also.	Student participation and activeness in answering the questions during class hours. Group discussions, MCQ, Objective, short answer type questions based on basic concepts and problem solving skills. Long answer type questions based on the course curriculum for determining the scientific temperament.

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**III**	**PHY CC 322**	**Computational Methods and Programming**	**Mid Sem 40 Mid Sem 60**	**04**

Course Objectives:

1. *To develop understanding of issues and solving them use of programming language like 'c'.*
2. *To introduced various numerical methods and solve the problems based on these methods using 'c' programming.*

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: Will be able to describe the basic Structure of C programming such as Variables, Expressions, Identifiers, Keywords, Data Types, Constants, Operator and expression Operator like Arithmetic, Logical and Relational and how to use it during program. Also they will gain knowledge about the use of Control Flow Statements such as If statement, If.....Else statement, Nesting of If....Else Statement, else if ladder, The ?: operator, go-to statement, Switch statement, Compound statement, Loop controls, for, while, do-while loops, break, continue.

CO2: Will get knowledge how to get the Solution of Algebraic and Transcendental Equations such as The Bisection method, Iteration methods, Newton-Raphson method. Learn how to get the Solution of Systems of Nonlinear Equations such as The method of iteration, Newton-Raphson method.

CO3: Will get more understanding about Curve Fitting and Approximation such as Least squares curve fitting, fitting a straight line and nonlinear curve fitting. Weighted least squire approximation: Linear weighted least squire approximation, Nonlinear weighted least squire approximation. Method of least squires for continuous functions.

CO4: Will get depth knowledge about the Numerical Differentiation like Introduction of its, errors in numerical differentiation, the cubic spline method.They will also understand the Numerical Integration such as Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Gaussian integration.

CO5: Will get knowledge about how to solve the Matrices and Linear Systems of Equations and learn its Basic definitions, matrix operations, transpose and inverse of a matrix. The Solution of linear systems, direct methods such as matrix inversion method, Gaussian elimination method.They will also understand the Solution of linear systems like Iterative method.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1: Will be able to describe the basic Structure of C programming such as Variables Expressions, Identifiers, Keywords, Data Types, Constants, Operator and expression Operator like Arithmetic, Logical and Relational and how to use it during program. Also they will gain knowledge about the use of Control Flow Statements such as If statement, If.....Else statement, Nesting of If....Else Statement, else-if ladder, The ?: operator, go-to statement, Switch statement, Compound statement, Loop controls, for, while, do-while loops, break, continue.	Audio- visual presentation as teaching aid showing the role of major contribution. White board based teaching with writing step by step instructions and flowcharts. Providing basic programs that can generally be run on a wide range of machines and devices, including computers, laptops, tablets and more. Books and notes sharing about this topic.	Students presentation and for beginners basic programs. They will do practice of writing and running program that will gives more better understanding.

2	CO2: Will get knowledge how to get the Solution of Algebraic and Transcendental Equations such as The Bisection method, Iteration methods, Newton-Raphson method. Learn how to get the Solution of Systems of Nonlinear Equations such as The method of iteration, Newton-Raphson method.	White board based teaching with writing step by step instructions and flowcharts. Use of Audio- visual presentation and focusing on the numerical solution of algebraic and transcendental systems. The arithmetical operations can solve in both way either by programming or by solving it in note book by doing both the things gives better understanding about problems.	Students should practice as much questions they can, firstly they must focus of basic problems but ones they get command in it they should do typical questions.
3	CO3: Will get more understanding about Curve Fitting and Approximation such as Least squares curve fitting, fitting a straight line and nonlinear curve fitting. Weighted least squire approximation: Linear weighted least squire approximation, Nonlinear weighted least squire approximation. Method of least squires for continuous functions.	Use of Audio- visual presentation and focusing on Curve Fitting and Approximation.White board based teaching with writing step by step instructions ans solving fundamental question of it. Books and notes sharing about this topic.	Students' think about curve fitting works and perform on computer. Various question should practice related to least squares fitting that gives better understanding.
4	CO4: Will get depth knowledge about the Numerical Differentiation like Introduction of its, errors in numerical differentiation, the cubic spline method.They will also understand the Numerical Integration such as Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Gaussian integration.	Use of Audio- visual presentation and focusing on Numerical Differentiation.White board based teaching with writing step by step instructions ans solving fundamental question of it. Books and notes sharing about this topic	Student can do presentation ans group discussion. They can so solve fundamental questions related to the topic

*Assessment tasks listed here are indicative, and may vary

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**III**	**PHY CC 323**	**Laboratory Course (Computer Programming)**	**Mid Sem 40 Mid Sem 60**	**02**

Course Objectives: ***The course is designed for -***

- To develop understanding of issues and ways of solving them with use of programming language like 'c'.
- To introduced various numerical methods and solve the problems based on these methods using 'c' programming.

Course Learning Outcomes:

Upon successful completion of the course, the student:

- Will be able to learn at least one programming language.
- Will be able to solve numerical/physics problems.
- Will be able to solve any numerical and physics problem with the help of 'c' programmes in a small spam of time.
- Will be know the importance of computer programming languages

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks*
1	The course will be developed skill of the students at least in one programming language like 'C'.They will be able to solve numerical/physics problems with the help of 'c' programmes in a small spam of time.	The computer programming laboratory equipped with C-language loaded computers is used to developed skill of hands on knowledge of 'C'-programming language among students	C-Programs prepared, short-out error issues, find out expected output of the problems by the course coordinator after doing periodic assessment of the Students

*Assessment tasks listed here are indicative, and may var

Department of Physics						
Class	**Subject**	**Semester**	**CourseCode**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**IV**	**PHY CC 324**	**Instrumentation Skills Development**	**MID SEM 40 END SEM 60**	**02**

Course objectives :

A workshop is way for someone to pass on the idea and methods. In workshop practices the information of tools and various machine used in workshop. To design and development of PCB for fabrication the simple circuitry .

COURSE LEARNING OUTCOMES :

The completion of course :

CO! : The students learn the entry rules and safety rules of workshop and follow the precaution during workshop practices

CO2 : The students learn the cutting process of iron rod with the help of hex saw and smooth the iron piece by using the different type of files .

CO2 : The students learn the operation of Lathe machine Shaper machine and single phase and three phase welding plant .

CO3 : The students learn the knowledge of resistance and its combination and testing by the multi-meter . The use of CRO to measure the frequency and amplitude and testing of components like diode, transistor , capacitor, inductance.

CO4 : The students learn making of Printed Circuit board with help of graph paper design and software design technique and made the simple circuitry .

CO5 : In over all the student get expertise in electronics instrumentation and measuring and testing the components and tools .

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**III**	**PHY SE 321**	**Seminar**	**Mid Sem 40 Mid Sem 60**	**02**

Course Objectives: *Objective of the seminar is to get student present themselves in front of audience and keep their views.*

Course Learning Outcomes:

The course every student compulsorily delivered a seminar of approximately 30 minutes duration on a topic as decided by the Departmental Seminar Committee.

Upon successful completion of the course, the student:

- Will be able to represent himself/herself in front of the audience.
- Will be able to learn how to defend the questions of audience?
- Will be able to learn the importance of the suggestions of audience.
- Will be able to developed better communication skill.
- Will be able to achieve higher level of confidence.
- Students will be ready for the future interviews.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
	The students will be able to represent himself/herself in front of the audience. They will be able to learn how to defend the questions of audience and importance of their suggestions. They will be developed better communication skill and achieved higher level of confidence. The course will be ready our students for the future interviews.	Audio-visual presentation (power point presentation) used as seminar presentation tool. They may use white board for descriptions, derivations and explanations etc.	The marks will be awarded by the Seminar Committee on the basis of presentation style, Presented topic and discussion with audience

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

Department of Physics						
Class	**Subject**	**Semester**	**CourseCode**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**III**	**PHY EC 321**	**Microprocessors and Microcontrollers.**	**MID SEM 40 END SEM 60**	**04**

Course Objectives: ***Objectives :*** **The objective of this course is to become familiar with the instruction set of an Intel microprocessor. Assembly language programming will be studied as well as the design. Understand the architecture of 8085, 8086 32 bit and microcontrollers.**

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: will able to describe the 8085 microprocessor with pin diagram, block diagram, addressing mode, and instruction set used in the programming of 8085 microprocessor.

CO2: Will able to describe the 8086 microprocessor, architecture, addressing, instruction set along with the 8089 coprocessor.

CO3: this unit gives the knowledge of 32 bits microprocessor along with the memory addressing and memory paging.

CO4: this unit gives the knowledge of memory interface with 8088 to 80486 microprocessor interface.

CO5: In this unit the idea of microcontroller is described for a dedicated task also with their memory architecture.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1: will able to describe the 8085 microprocessor with pin diagram, block diagram, addressing mode, and instruction set used in the programming of 8085 microprocessor	Visual presentation as teaching aid. Use of white black board for drawing circuit diagrams. Discussion on the application of the 8085 microprocessor.	Student group discussion on the 8085 microprocessor and its applications. Objective type, short and long questions, along with programming training on kit.
2	CO2: Will able to describe the 8086 microprocessor, architecture, addressing, instruction set along with the 8089 coprocessor.	Computer based teaching like ppt presentation, give idea about the 8086 microprocessor, programming skill and the role co-processor	Student group discussion, along with programming training on kit.

3	CO3: this unit gives the knowledge of 32 bits microprocessor along with the memory addressing and memory paging	Discussion with students regarding microprocessor and the memory addressing and memory paging which involves the study of a microprocessor architecture and its components in detail	Discussion with student and among students with objective and subjective type questions and answers, along with programming training on kit.
4	CO4: unit gives the knowledge of memory interface with 8088 to 80486 microprocessor interface	Discussion with students about 8088 and 80486 microprocessors and how these are interfaced with memory. It also involves teaching of Address decoding	Discussion with students, asking and telling about daily applications of microprocessors and memory interfacing, along with programming training on kit.
5	CO5: In this unit the idea of microcontroller is described for a dedicated task also with their memory architecture.	Teacher interacts with the students to discuss different types of microcontrollers and instruction sets, differences between CISC and RISC.	Discussion with student and among students with objective and subjective type questions and answers, along with programming training on kit.

*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**
M.Sc.	**Physics**	**III**	**PHY EC 322**	**Material Science**	**Mid Sem 40 End Sem 60**	**04**

Course Objectives: To get aware about the all types of materials. Classification of materials and to learn various synthesis and characterization technique. Disorder/imperfect materials and their types. Idea about thermal studies and phase diagram studies, solidification and various application to devices applications of materials.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1:Will be able to classify different types materials. Also they will gain knowledge about crystal structures of different crystals.

CO2: Will get knowledge about the preparation of materials and their method of characterization. They will also gain knowledge about the different analysis techniques.

CO3:Will get an in depth knowledge about the various disorder in solids and how to detect them.

CO4:Will get an understanding about Phase diagram and Phase transformations with different examples..

CO5: Will understand about different material devices and their applications.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1: Will be able to classify different types materials. Also they will gain knowledge about crystal structures of different crystals.	Audio-visual presentation as teaching aid showing the role of different materials and their classification. Use of white/black board for drawing complex diagram of crystal structures. Discussion on the properties of materials through detailed lecture and extended Q&A sessions.	Student presentation and group discussion on different materials. Objective type short and long questions.
2	CO2: Will get knowledge about thepreparation of materials and their method of characterization. They will also gain knowledge about the different analysis techniques.	Black/white board based teaching with notes and drawing diagrams to show important features of major characterization techniques. Extended Q&A to involve each student in the classroom. Use of audio visual presentation to aid the teaching.	Seminar were delivered by every students on different characterization techniques. Visual aid quiz for different characterization techniques.
3	CO3:Will get an in depth knowledge about the various disorder in solids and how to detect them.	Thought provoking questions and student involvement through their participation. Use of black/white board for explanation and drawing pathways/flowcharts. Use of audio visual presentation as teaching aid to discuss the disorder in solids.	Assignments were given to every student. Organized Seminar and group discussion.

4	CO4:Will get an understanding about Phase diagram and Phase transformations with different examples.	Phase diagram and their transformations are discussed in great details with black/white board , audio-visual presentation etc. The notes and lecture about the representative example of various phase diagrams are discussed. Extended Q&A session about the topic.	Student presentation and group discussion. Objective type, short and long questions.

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**III**	**PHY EC 323**	**Laser Physics & Optical Fiber**	**100**	**04**

Course Objectives: The objective of this course is to provide the sound knowledge about Lasers and Optical fiber to the students. Students should be familiar with the applications of laser in various areas like defense, communication, medical etc.

Course Learning Outcomes:

Upon successful completion of the course, the student:

Unit 1: able to understand the basic physics behind laser and its parts and their requirement.

Unit 2: will be acquainted to the properties of laser beam and its dependency on cavity, also how to generate short and ultra short lasers

Unit 3: will learn different types of laser and their working

Unit 4: students will learn about applications of laser and some new phenomenon of physics viz Non linear optics

Unit 5: will get basics of optical fiber and the losses in optical fiber during the propagation of optical signals

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**IV**	**PHY CC 421**	**Advance Quantum Mechanics**	**100**	**04**

Course Objectives: To familiarize the students with time dependent quantum systems and their applications. To give the exposure of quantum theory for different types of scattering at sub atomic level. Also teach the concepts of quantum mechanics including the relativistic effects and quantization of radiation.

Course Learning Outcomes:

Upon successful completion of the course, the student:

Unit 1: will know the solution of Schrödinger equations for different types of time dependent Hamiltonians

Unit 2: will be acquainted to the theory of Radiation and electric dipole radiation

Unit 3: will learn in detail about the scattering ,explanations of different types of scattering at atomic level using the partial wave analysis and Born approximation methods and their limitations

Unit 4: will learn the basics of relativistic quantum mechanics and its application for sub atomic particles as electron its interaction energy, magnetic moment etc.

Unit 5: will be familiar to the quantization of radiation, second quantization and its application for system of Boson and system of Fermions. Students will also learn about quantization states using number operators.

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

Department of Physics						
Class	**Subject**	**Semester**	**CourseCode**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**IV**	**PHYCC 422**	**Nuclear and Particle Physics**	**Mid Sem 40 End Sem 60**	**04**

Course Objectives:

This is a basic course in physics which deals with the phenomena taking place in the nuclear domain. The major objective of this course is to give insight into the basics of nucleus which is the main constituent of any atom, to understand various models used to explain the nucleus, radioactivity, nuclear reactions, elementary particles, conservation laws.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: Will be able to understand the basic properties of nucleus, stability of nucleus, can determine nuclear size.

CO2: Will learn about various type of nuclear radiation and their interaction with matter.

CO3: Will understand various models used to explain the nucleus, nuclear reactions and conservation laws.

CO4: Will learn about various types of accelerators used in nuclear Physics and various types of detectors used to detect nuclear radiations.

CO5: Will learn about the elementary particles, the basic building blocks of nuclear matter and their properties.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1: Will be able to understand the basic properties of nucleus, stability of nucleus, can determine nuclear size.	Discussion on basic properties of nuclei. Extended Q&A sessions. Use of white board and ppt presentation for eplanation and derivation.	Student presentation and group discussion. Objective type, short and long questions.
2	CO2: Will learn about various type of nuclear radiation and their interaction with matter.	Use of white board and ppt presentation for explanation and derivation. Extended Q&A session to involve each student in the classroom.	Student presentation and group discussion. Objective type, short and long questions.
3	CO3: Will understand various models used to explain the nucleus, nuclear reactions and conservation laws.	Use of white board and ppt presentation for explanation and derivation. Extended discussion and Q&A session to involve each student in the classroom.	Student presentation and group discussion. Objective type, short and long questions. .
4	CO4: Will learn about various types of accelerators used in nuclear Physics and various types of detectors used to detect nuclear radiations.	Use of white board and ppt presentation for explanation and derivation. Extended discussion and Q&A session to involve each student in the classroom.	Student presentation and group discussion. Objective type, short and long questions.
5	CO5: Will learn about the elementary particles, the basic building blocks of nuclear matter and their properties.	Use of white board and ppt presentation for notes, explanation and derivation. Extended discussion and involvement of each student in the classroom. Q&A session.	Student presentation and group discussion. Objective type, short and long questions.

Department of Physics						
Class	**Subject**	**Semester**	**CourseCode**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**IV**	**PHY SE 423**	**Digital Communication Skills Development**	**MID SEM 40 END SEM 60**	**02**

The objective of the course is understanding the students to design and trouble shoot the digital communication circuits .The aim of the course to equip the students with in electronics communication to know how the signal travel in digital and optical forms .

COURSE LEARNING OUTCOMES :

The completion of course :

CO1 : The students learn how to convert the continues analogue signal in sample form with the help of sampling frequency and reconstruct the analogue signal with the help of active filter .

CO 2 : The student learn the modulation of signal with pulse amplitude ,Pulse width and pulse position . In demodulation method the students know the working of second order and fourth order active low pass filter .

CO3 : The pulse code modulation technique the students learn how the sampled signal is digitally coded with the help of pulse code modulation circuits . In demodulation technique decode the coded signal with the help of parity bit , and know the drawback of PCM technique.

CO4 : By the delta & adaptive delta modulation and demodulation students learn how to remove the drawback of PCM technique .

CO5 : The students learn the method of multiplexing technique like frequency division and time division multiplexing. In overall students will get expertise in Digital communication system .

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**IV**	**PHY SE 422**	**Seminar**	**Mid Sem 40 Mid Sem 60**	**02**

Course Objectives: *Objective of the seminar is to get student present themselves in front of audience and keep their views.*

Course Learning Outcomes:

The course every student compulsorily delivered a seminar of approximately 30 minutes duration on a topic as decided by the Departmental Seminar Committee.

Upon successful completion of the course, the student:

- Will be able to represent himself/herself in front of the audience.
- Will be able to learn how to defend the questions of audience?
- Will be able to learn the importance of the suggestions of audience.
- Will be able to developed better communication skill.
- Will be able to achieve higher level of confidence.
- Students will be ready for the future interviews.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
	The students will be able to represent himself/herself in front of the audience. They will be able to learn how to defend the questions of audience and importance of their suggestions. They will be developed better communication skill and achieved higher level of confidence. The course will be ready our students for the future interviews.	Audio-visual presentation (power point presentation) used as seminar presentation tool. They may use white board for descriptions, derivations and explanations etc.	The marks will be awarded by the Seminar Committee on the basis of presentation style, Presented topic and discussion with audience

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

Department of Physics						
Class	**Subject**	**Semester**	**CourseCode**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**IV**	**PHY EC 421**	**VLSI Design**	**MID SEM 40 END SEM 60**	**03**

Course Objectives: ***Objectives :*** **The objective of this course is to become familiar with the MOS Transistor and CMOS logic, also the MOST transistor theory and their fabrication and processing technology.**

Course Learning Outcomes:

Upon successful completion of the course, the student:
CO1: will able to describe the MOS transistor and CMOS logic
CO2: will able to describe the CMOS fabrication layout and simulation.
CO3: this unit gives the knowledge of 32 I-V, C-V MOS transistor characteristics.
CO4: this unit gives the knowledge of photolithiography, wall and channel formation and gate and source/drain formation.
CO5: In this unit the idea of layout design rules with background structure..

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1 will able to describe the MOS transistor and CMOS logic	Visual presentation as teaching aid. Use of white black board for drawing circuit diagrams. Discussion on the NAND and NOR gate combinational logics, compound gates, pass transistors transmission gates and flip-flops.	Student group discussion on the MOS transistor and CMOS logics. Objective type, short and long questions, along with training on software.
2	CO2: will able to describe the MOS transistor and CMOS logic.	Computer based teaching like ppt presentation, give idea about the VLSI design flow, design fabrication with suitable diagrams and visuals.	Student group discussion, along with training in software.
3	CO3: this unit gives the knowledge of 32 I-V, C-V MOS transistor characteristics.	Discussion with students regarding the I-V and C-V characteristics, non-ideal I-V effects, also DC transfer characteristics.	Discussion with student and among students with objective and subjective type questions and answers, along with training on software.
4	CO4: this unit gives the knowledge of photolithography, wall and channel formation and gate and source/drain formation.	Discussion with students about Background wafer formation, photolithography, wall and channel formation.	Student group discussion on the photolithography Objective type, short and long questions, along with training on software.
5	CO5: : In this unit the idea of layout design rules with background structure	Teacher interacts with the students to discuss about designing rule background, scribe line and other structure, MOSIS and CMOS design rule, Micron design rule.	Student group discussion, along with training in software.

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

Department of Physics						
Class	**Subject**	**Semester**	**Course Code**	**Course Title**	**Marks**	**Credit**
M.Sc.	**Physics**	**IV**	**PHY EC 422**	**Physics of Nanomaterials**	**Mid Sem 40 End Sem 60**	**04**

Course Objectives: The main objective of this course is to aware and teach about nanomaterials, their different synthesis methods, their properties, introduction with special carbon and their application in various fields.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: Will be able to describe different type of nanomaterials and their size and dimensionality effect. Also they will gain knowledge about quantum confinement, tunneling of a particle through a potential barrier, structure and bonding, electronic structure of solids and excitons.

CO2:Will get knowledge about the different Top-down and bottom –up approach for synthesis of nanomaterials.

CO3: Will get to know about different properties of nanomaterials

CO4: Will understand about special carbons and application of carbon nanotubes.

CO5: Will get to about the application of nanotechnology in various fields.

Facilitating the achievement of Course Learning Outcomes

Unit	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1	CO1: Will be able to describe different type of nanomaterials and their size and dimensionality effect. Also they will gain knowledge about quantum confinement, tunneling of a particle through a potential barrier, structure and bonding, electronic structure of solids and excitons.	Audio-visual presentation as teaching aid showing the role ofnanomaterials and their classification. Use of white/black board for teaching quantum confinement and electronic structure of solids. Discussion on the bonding and excitons through detailed lecture and extended Q&A sessions	Student presentation and group discussion on different nanomaterials. Objective type short and long questions.
2	CO2: Will get knowledge about the different Top-down and bottom –up approach for synthesis of nanomaterials	Black/white board based teaching with notes and drawing diagrams to teach different synthesis techniques. Extended Q&A to involve each student in the classroom. Use of audio visual presentation to aid the teaching.	Seminar were delivered by every students on different characterization techniques. Visual aid quiz for different characterization techniques

3	CO3: Will get to know about different properties of nanomaterials	Mechanical, structural, electrical, optical and magnetic properties are discussed in great details with black/white board , audio-visual presentation etc. The notes and lecture about the various properties are discussed. Extended Q&A session about the topic	Assignments were given to every student. Organized Seminar and group discussion.
4	CO4: Will understand about special carbons and application of carbon nanotubes.	Carbon cluster, C_{60} , fullerene and carbon nanotubes are discussed in great details with black/white board , audio-visual presentation etc. The notes and lecture about the application of carbon nanotubes are discussed. Extended Q&A session about the topic.	Student presentation and group discussion. Objective type, short and long questions
5	CO5: Will get to about the application of nanotechnology in various fields.	Use of internet, computer to show short movies about different application of nanomaterial . The student will take part in extended Q&A sessions during and after each topic about the application of nanotechnology.	Poster and ppt presentation. Objective type , short and long questions.

*Assessment tasks listedhereareindicative, and mayvary.