M.Sc. Physics

Program outcome M.Sc. Physics.

1. Understands the role of physics in society and its background to consider ethical problems.
2. Know the historical development of physics, its possibilities, limitations, and understands the value of lifelong learning.
3. Ability to gather, assess, and make use of new information.
4. Ability to successfully carry out advanced tasks and projects, both independently and in collaboration with others, and also across disciplines.
5. To provide adequate background for pursuing pedagogic education.
6. To have universal perspective on discipline.

Program specific outcome: M.Sc. Physics

1. Understanding the basic concepts of physics in classical mechanics, quantum mechanics, statistical mechanics and electricity and magnetism to appreciate how diverse phenomena observed in nature follow from a small set of fundamental laws through logical and mathematical reasoning.
2. Learn to carry out experiments in basic as well as certain advanced areas of physics such as nuclear physics, condensed matter physics, Nano science, lasers and electronics, optics, electricity and magnetism.
3. Understand the basic concepts of certain sub fields such as nuclear and high energy physics, atomic and molecular physics, solid state physics, plasma physics, general theory of relativity, Radiation, Reactor physics and electrodynamics
4. Gain hands on experience to work in applied fields of different branches of Physics.
5. Physics as a training ground for the mind developing critical attitude and logical reasoning that can be applied to research and development in diverse fields of science.

Course Outcomes

Paper Name: Classical Mechanics

Class: M.Sc.(Physics) Semester: 1st

Objectives of the Courses:

1. 1. The major objective of the course is to develop a better understanding of classical physics.
2. To cultivate skills at formulating and solving physics problems.
3. To develop familiarity with the physical concepts and mathematical methods of classical mechanics.
4. Provide the student with different practical, intellectual and transferable skills.
5. Use the tools, methodologies, language and conventions of physics to test and communicate ideas and explanations

Course Outcomes:

- **Knowledge and Understanding:**

The Students :

- Langrangian and its applications in all cases.
- the difference between classical and quantum physics.
- Hamiltonian and its applications in all cases.
- Kepler's law and its applications in various orbital aspects.

- **Intellectual (Cognitive/ Analytical) Skills:**

Students will be able to:

- Think critically about the theories of physics.
- Think critically about the contribution of various scientists in the classical world.
- Think critically about the contribution of Newton's laws in our day to day life.
- Think critically about the contribution of Euler's Equation in solving various problems.
- Think critically about the use of physics in our daily life.

.**Practical Skills:**

Students will learn to

1. Apply appropriate mathematical techniques to solve classical physics problems.
2. Apply appropriate techniques to study Langrangian and Hamiltonian problems.
3. Discuss applications of the topics included in the Classical physics course, and appreciate their relation to other topics in course components taken.

- **Tranferable skills:**

Students will be able to:

- Learn to think more creative as well as comparatively.
- Apply logical analysis to problem solving;
- Contribute to the management of a group engaged in project work
- Develop the ability of the students to deal with various particle distributions classically as well as using quantum mechanics and formulas mathematically.
- Prepare and deliver a presentation and report of group work.
- Apply team-working skills to address a complex physics problem and contribute significantly to the work of a group tackling such a problem

Paper Name: Electrodynamics-I

Class: M.Sc. (Physics) Semester: 2nd

Objectives of the Course:

1. The major objective of the course is to make the students familiar with the vast implications of Electricity and Magnetism
2. To cultivate skills at formulating and solving physics problems.
3. To develop familiarity with the physical concepts and mathematical methods of electrodynamics.

Course Outcomes:

A. Knowledge and Understanding:

Students will:

- Know how to define Electrostatics and Electrodynamics.
- Understand Maxwell equations and their importance.
- Properties of electromagnetic waves.

B. Intellectual (Cognitive/ Analytical) Skills:

Students will be able to:

- Think critically about the theories of physics.
- Think critically about the contribution of various scientists in the field of electrodynamics.
- Understand that how a charge on single electron does plays a crucial role in understanding the world of current and magnetism.
- Think critically about the wave particle duality nature.
- Think critically about the use of physics in our daily life.
- Think critically about how electricity and magnetism plays a crucial role in day to day life.
- Think critically about how electromagnetic wave theory plays an important role in telecommunication.

C. Tranferable skills:

Students will be able to:

- Use concepts of physics more effectively.
- Learn to think more creative as well as comparatively.
- Project planning.
- Problem solving

Paper Name: Quantum Mechanics-I

Class: M.Sc. (Physics) Semester: 2nd

Objectives of the Course:

1. The major objective of the course is to develop a better understanding of Quantum Physics of sub atomic particles.
2. To cultivate skills at formulating and solving physics problems.
3. To develop familiarity with the physical concepts and mathematical methods of quantum mechanics.
4. Provide the student with different practical, intellectual and transferable skills.

Course Outcomes:

D. Knowledge and Understanding:

Students will come to know about:

- Dirac notation and its advantage above other notations.
- the difference between classical and quantum physics.
- How to handle algebra of orbital angular momentum.

E. Intellectual (Cognitive/ Analytical) Skills:

Students will be able to:

- Think critically about the theories of physics.
- Think critically about the contribution of various scientists in the quantum world.
- Identify the process of how spin of individual electron plays a crucial role in understanding the world of microscopic bodies.
- Think critically about the wave particle duality nature.
- Learn about degenerate states of same energy level.
- Think critically about the use of physics in our daily life.

F. Tranferable skills:

Students will be able to:

- Use concepts of physics more effectively.
- Learn to think more creative as well as comparatively.
- Project planning.
- Problem solving

Paper Name: Statistical Mechanics

Class: M.Sc. Physics Semester: 2nd

Objectives of the Courses:

This course introduces students to the fundamental concepts of building up complexity from elementary constituents in the framework of thermodynamics and statistical physics. Starting with an overview of the kinetic theory of gases, this course develops concepts in classical laws of thermodynamics and their application, postulates of statistical mechanics, statistical interpretation of thermodynamics, micro-canonical, canonical and grants canonical ensembles. Various methods of statistical mechanics are used to develop the statistics for Bose-Einstein,

Fermi-Dirac and photon gases; selected topics from low temperature physics and electrical and thermal properties of matter are discussed.

Learning Outcomes:

1. Explain statistical physics and thermodynamics as logical consequences of the postulates of statistical mechanics.
2. Apply the principles of statistical mechanics to selected problems.
3. Apply techniques from statistical mechanics to a range of situations.
4. Use the tools, methodologies, language and conventions of physics to test and communicate ideas and explanations
5. Use the tools, methodologies, language and conventions of physics to test and communicate ideas and explanation.
6. The major objective of the course is to to impart knowledge about basic statistical physics properties and their relation with thermodynamics for understanding of various particle distributions in ensembles.
7. To cultivate skills at formulating and solving physics problems.
8. Provide the student with different practical, intellectual and transferable skills.

Course Outcomes:

- **Knowledge and Understanding:**

The Students :

- Achieved the ability to explain the various ensembles and their properties.
- Explain the various laws of thermodynamics and all the thermo dynamical processes along with their essential variables.
- Have a basic knowledge of energy fluctuations in canonical ensemble.
- Acquires knowledge of properties of all types of magnetic substances like paramagnetic, diamagnetic and their properties and susceptibility.
- Acquires knowledge of all quantum states and phase space.
- Describe the role of Bose Einstein Condensation and their all concepts in brief.
- read, understand and explain scholarly journal articles in statistical physics

- **Intellectual(Cognitive/ Analytical) Skills:**

Students will be able to:

- Describe and analyze quantitatively processes, relationships and techniques related to the areas covered in the statistical physics course;
- Develop a clear understanding of the basic concepts in statistical mechanics physics.
- Explain the various types of ensembles and to study particle distribution in various ensembles.
- Use the physical knowledge to analyze a suitable technique to solve problems.
- Use basic laboratory equipment and construct a solid foundation for advanced statistical mechanics physics course.
- Be able to outline the importance of statistical physics and its various applications in the modern society.
- **Practical Skills:**

Students will learn to

4. Apply appropriate mathematical techniques to solve statistical physics problems.
5. Apply appropriate laboratory techniques to study particle distribution in phase space.
6. Discuss applications of the topics included in the statistical physics course, and appreciate their relation to other topics in course components taken.
7. Develop the ability of the students to conduct, observe, analyzes and report an experiment

- **Tranferable skills:**

Students will be able to:

- Use concepts of statistical mechanics physics more effectively.
- Learn to think more creative as well as comparatively.
- Apply logical analysis to problem solving;
- Contribute to the management of a group engaged in project work
- Develop the ability of the students to deal with various particle distributions classically as well as using quantum mechanics and formulas mathematically.
- Prepare and deliver a presentation and report of group work.

- Apply team-working skills to address a complex physics problem and contribute significantly to the work of a group tackling such a problem

Paper Name : Atomic and Molecular Spectroscopy

Class: M.Sc. Physics Semester: II

Objectives of the Course:

Atoms and molecules are the fundamental units for all matters in the Universe. Whatever state of matter it is made of atoms. All the properties of matter are governed by the electronic structure of atoms and molecules. The individual properties of atoms like electronic, magnetic and optical are quite different from the collective properties of matter made of atoms and molecules. This course enlightens the knowledge of structure of atoms and molecules with various spectroscopic techniques.

Course Outcomes:

A. Knowledge and Understanding:

Students will learn

- About the structure of atom and molecules with various theoretical and experimental observations.
- Understand and explain basic concepts of different spectroscopic techniques to explore the physical and chemical properties of matter.
- Students will understand interdisciplinary approach of spectroscopy in other branches of science.

B. Intellectual (Cognitive/Analytical) Skills:

Students will be available to

- Analyze atomic and molecular spectra to explore the structure of materials and their constituents.
- Analyze fourier Transform Infra-red spectra for molecular bonding.
- Analyze UV-VIS spectra for electronic spectra.
- Analyze Raman Spectra for different types of molecules

C. Practical Skills

Students will learn to

- The use spectrometer for different electromagnetic radiations and their interaction with materials.
- Basics of different components of spectroscopy in experimental setup.
- Experimental verification of theoretical models.

D. Transferable Skills:

Students will be able to transfer the theoretical and experimental skills to other branches of science like medical science and material engineering.

Paper Name: Quantum Mechanics-II PHY: 501

Class: M.Sc. (Physics) Semester: III

Objective of the Course:

Quantum Mechanics-II is a basic continuation course in quantum mechanics that aims at the applications of quantum mechanics. The aim of the course is that the students acquire in-depth knowledge about the foundations of quantum mechanics, as well as skills in applying quantum mechanics in advanced problems. The course offers a systematic introduction to fundamental non-relativistic quantum and gives an introduction to relativistic quantum mechanics.

Course Outcomes:

A. Knowledge and understanding:

Students will

- Learn about basic non-relativistic quantum mechanics
- Study about the approximate methods for solving Schrödinger equations such as perturbation theory, variational method and Born approximations.
- Gain knowledge about relativistic quantum mechanics
- Become familiar with the study of identical particles in quantum mechanics

B. Intellectual (Cognitive/Analytical) skills:

Students will

- general experience with non-relativistic quantum mechanics that is useful for further studies in theoretical physics, as well as nanotechnology

- knowledge about fundamental quantum mechanical processes in nature
- experience using mathematical tools to construct approximate quantum mechanical models.

C. Practical skills:

Students will learn to:

1. apply the variational method, time-independent perturbation theory and time-dependent perturbation theory to solve simple problems
2. apply principles of quantum mechanics to calculate observables on known wave functions.

D. Transferrable skills:

- Communication skills
- Thinking skills
- Project planning
- Problem solving

Paper Name: Condensed Matter Physics-I PHY: 503

Class: M.Sc. (Physics) Semester: IIIrd

Objective of the Course:

This course aims to establish fundamental concepts in condensed matter physics, and applies the physics you have learned previously (in particular quantum mechanics, classical mechanics, electromagnetism and statistical mechanics) to these real-world materials. The structure and properties of solids including thermal and electrical properties are described in detail. It also aims to explore the students with principle, theory and mathematical calculations involved in various instruments.

Course Outcomes:

A. Knowledge and understanding:

Students will

- have a basic knowledge of lattice specific heat and elastic constants.

- understand the concept of point defects and be able to use it as a tool .
- know the significance of grain boundaries .
- know the fundamental principles of mean free path in metals and qualitative discussion of the features of resistivity.
- know basic models of dipole theory and thermodynamics of ferroelectric transitions..

B. Intellectual (Cognitive/Analytical) skills:

Students will

- be able to outline the importance of solid state physics in the modern society.
- be able to perform structure determination of simple structures.
- Industrial applications.

C. Practical skills:

Students will learn to:

- Apply appropriate mathematical techniques to solve different theories of lattice specific heat.
- Think in graphical terms and approximate terms when appropriate.
- Perform statistical analysis, and a willingness to question fundamentals.
- Apply appropriate laboratory techniques to measure conductor properties.
- Understand the operation and characteristics of various conducting devices.

D. Transferrable skills:

- Communication skills.
- Thinking skills.
- Project planning.
- Problem solving.

Paper Name: Nuclear Physics

Class: M.Sc. Physics Semester: 3rd

Objectives of the Courses:

This course introduces students to the fundamental concepts of building up complexity from elementary constituents in the framework of nuclear and sub-nuclear physics. Starting with an overview of the development of nuclear and particle physics, the course builds on previous learning in quantum mechanics and electromagnetism to develop students' understanding of the properties of the strong and weak forces.

1. The course introduces the principles of nuclear physics by studying the constituents of the nucleus and the natural radioactivity.
2. The major objective of the course is to to impart knowledge about basic nuclear physics properties and nuclear models for understanding of related reaction dynamics
3. To cultivate skills at formulating and solving physics problems.
4. Provide the student with different practical, intellectual and transferable skills.

Course Outcomes:

- **Knowledge and Understanding:**

The Students:

- Achieved the ability to explain the ground state properties of the nucleus for study of the nuclear structure behavior.
- Explain the deuteron behavior at ground and excited states and apply deuteron model to explain the Nucleon-Nucleon scattering for explaining the nuclear forces.
- Have a basic knowledge of nuclear systems and various nuclear exchange forces between nucleons.
- acquires knowledge of constituents and properties of nuclei, nuclear reactions and accompanying radiations, as well as mechanisms for the interaction of radiation with matter
- Acquires knowledge of nuclear properties, various nuclear models, nuclear reactions, with emphasis on alpha, beta and gamma radiation related to strong, weak and electromagnetic interactions.

- describe the role of spin-orbit coupling in the shell structure of atomic nuclei, and predict the properties of nuclear ground and excited states based on the shell model
- analyze production and decay reactions for fundamental particles, applying conservation principles to determine the type of reaction taking place and the possible outcomes
- Apply various aspects of nuclear reactions in view of compound nuclear dynamics
- read, understand and explain scholarly journal articles in nuclear and particle physics

- **Intellectual(Cognitive/ Analytical) Skills:**

Students will be able to:

- Describe and analyze quantitatively processes, relationships and techniques related to the areas covered in the nuclear physics course;
- Develop a clear understanding of the basic concepts in nuclear physics. Explain the nuclear binding energy in detail.
- Show the difference between nuclear fission and fusion reactions.
- Use the physical knowledge to analyze a suitable technique to solve problems.
- Use basic laboratory equipment.
- Construct a solid foundation for advanced nuclear physics course.
- Apply the laws governing the radioactivity
- Be able to outline the importance of nuclear physics in the modern society.

- **Practical Skills:**

Students will learn to:

8. Apply appropriate mathematical techniques to solve nuclear physics problems.
9. Apply appropriate laboratory techniques for the detection of nuclear radiations.
10. Discuss applications of the topics included in the nuclear physics course, and appreciate their relation to other topics in course components taken.
11. Develop the ability of the students to conduct, observe, analyzes and report an experiment.

- **Transferable skills:**

Students will be able to:

- Use concepts of nuclear physics more effectively.
- Learn to think more creative as well as comparatively.
- Apply logical analysis to problem solving;
- Contribute to the management of a group engaged in project work
- Develop the ability of the students to deal with various nuclear models and formulas mathematically.
- Prepare and deliver a presentation and report of group work.
- Apply team-working skills to address a complex physics problem and contribute significantly to the work of a group tackling such a problem.

Paper Name: Particle Physics PHY: 551

Class: M.Sc. (Physics) Semester: IV

Objective of the Course:

The objectives of particle physics are to identify the simplest objects out of which all matter is composed and to understand the forces which cause them to interact and combine to make more complex things. The subject aims to acquaint students with basic laws of nuclear and particle physics. It helps to develop the capability of elementary problem solving and relating theoretical predictions and measurement results amongst students.

Course Outcomes:

A. Knowledge and understanding:

Students will

- understand the elementary particles and their classification.
- will be able to determine of mass, life time, decay mode, spin and parity of various sub atomic particles.
- know about the symmetries and conservation laws involving high energy particles.
- know about weak interactions, their classification and theories involving these decays such as Fermi theory and Cabibbo's theory
- learn about field equations for scalar, spinor , vector fields

- gain information about Standard Model

B. Intellectual (Cognitive/Analytical) skills:

Students will

- Explore the substructures of matter.
- be able to co-relate the theoretical and practical aspects of the subject.
- Become aware of the applicability of the theories in research and development.

C. Practical skills:

Students will learn to:

- Apply appropriate mathematical techniques to solve elementary problems.
- Apply appropriate laboratory techniques to measure various properties of sub atomic particles.
- Understand the mode and decay behaviour of various particles

D. Transferrable skills:

- Communication skills
- Thinking skills
- Project planning.
- Problem solving.

Paper Name: Condensed Matter Physics-II

Class: MS.c Physics Semester: 4th

Objectives of the Courses:

1. Provide the student with a broad spectrum of physics courses.
2. Emphasize the role of physics in life and other discipline (chemistry ,mathematics and biology).
3. Develop the ability of the students to conduct, observe, analyzes and report an experiment.
4. Develop the ability of the students to deal with physical models and formulas mathematically.
5. Provide the student with different practical, intellectual and transferable skills.

Course Outcomes:

A. Knowledge and Understanding:

Students will:

- have a basic knowledge of crystal systems and spatial symmetries.
- understand the concept of reciprocal space and be able to use it as a tool .
- know the significance of Brillouin zones .
- know the fundamental principles of semiconductors, including pn-junctions, and be able to estimate the charge carrier mobility and density.
- know basic models of magnetism .
- know what phonons are, and be able to perform estimates of their dispersive and thermal properties

B. Intellectual(Cognitive/ Analytical) Skills:

Students will be able to:

- Account for interatomic forces and bonds.
- be able to account for how crystalline materials are studied using diffraction, including concepts like the Ewald sphere, form factor, structure factor, and scattering amplitude.
- be able to account for what the Fermi surface is and how it can be measured
- be able to outline the importance of solid state physics in the modern society.
- be able to perform structure determination of simple structures

C. Practical Skills:

Students will learn to:

- Apply appropriate mathematical techniques to solve semiconductor problems.
- Apply appropriate laboratory techniques to measure semiconductor properties.
- Understand the operation of semiconductor devices
- Apply appropriate laboratory techniques to measure semiconductor device characteristics

D. Tranferable skills:

Students will be able to:

- Use concepts of physics more effectively.
- Learn to think more creative as well as comparatively.
- project planning.
- Problem solving.

Paper Name: Reactor Physics

Class: MS.c Physics Semester: 4th

Objectives of the Courses:

1. Provide the student with a broad spectrum of physics courses.
2. Emphasize the role of physics in life and other discipline (chemistry ,mathematics and biology).
3. Develop the ability of the students to conduct, observe, analyzes and report an experiment.
4. Develop the ability of the students to deal with physical models and formulas mathematically.
5. Provide the student with different practical, intellectual and transferable skills.

Course Content:

Thermal neutron diffusion, transport mean free path, slowing down power and moderating ration of a medium. Slowing down density, slowing down time, Neutron cycle and multiplication factor, four factor formula, neutron leakage,Advantages and disadvantages of heterogeneous assemblies, various types of reactors with special reference to Indian reactors, Breeding ratio, breading gain, doubling time, Fast breeder reactors, fission product poisoning, use of coolants and control rods.

Course Outcomes:

A. Knowledge and Understanding:

Students will:

- Know how to define a various branches of Nuclear physics(eg. Radiation physics, Reactor physics, Particle Physics).
- Understand and explain the basic concepts associated with the Reactor Physics (eg. Moderation of neutrons, Thermal Neutrons, working of nuclear reactor)
- Students will understand and able to describe the difference between the various Reactor processes.

B. Intellectual(Cognitive/ Analytical) Skills:

Students will be able to:

- Think critically about the theories of physics.
- Think critically about the contribution of various scientists in the particle world.
- work with others in task-oriented groups, productively participating and interacting in the group.
- Learn the conversion of fertile material to fissionable material.
- Think critically about the use of physics in our daily life.

C. Practical Skills:

Students will learn to:

- Detect the Beta Particals with the help of GM Counter.
- Study the properties of different elements.
- Measuring a activation of material in reactor.
- Study of Mass defect(mass reduced after reaction and that reduced mass changes into energy).
- Study types of nuclear reactors in our country.

D. Transferable skills:

Students will be able to:

- Use concepts of physics more effectively.

- Learn to think more creative as well as comparatively.
- project planning.
- Problem solving.

Paper Name: Radiation Physics PHY: 562

Class: M.Sc. (Physics) Semester: IV

Objective of the Course:

This course aims at acquainting students with various concepts and basic techniques essential for conduct of practical and research work in the field of radiation physics and dosimeters and have an understanding of scientific knowledge. It also aims to explore the students with principle, theory and mathematical calculations involved in various instruments.

Course Outcomes:

- **Knowledge and understanding:**
  - Basic understanding about ionizing radiation fields.
  - Students will learn the basic dosimeters to detect different types of radiations
  - Students will learn about various effects of radiations and how to get shielded from those effects in detail.
  - Students will gain knowledge in areas relating to radiation physics
- **Intellectual (Cognitive/Analytical) skills:**
  - Use of radiation physics in medical science
  - Industrial applications
- **Practical skills:**
  - Safe handling of radioactive isotopes
  - Operation of neutron dosimeters
  - Measurement of gamma dose
- **Transferrable skills:**
    - Communication skills
    - Thinking skills

- Education

Paper Name: Mathematical Physics

Class: M.Sc. (Physics) Semester: 1st

Objectives of the Courses:

1. The major objective of the course is to develop a better understanding of different mathematical aspects of physics and how to tackle mathematical difficulties in Physics.
2. To cultivate skills at formulating and solving physics problems.
3. Provide the student with different practical, intellectual and transferable skills.
4. Use the tools, methodologies, language and conventions of physics to test and communicate ideas and explanations

Course Outcomes:

- **Knowledge and Understanding:**
- Fourier and Laplace Transform.
- Tensor Notations.
- Methods to solve differential equations.

- **Intellectual (Cognitive/ Analytical) Skills:**

Students will be able to:

- Think critically about the theories of physics.
- Think critically about the contribution of various scientists in the mathematical world.
- Think critically about the contribution of Euler's Equation in solving various problems.
- Think critically about the use of physics in our daily life.

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- **Practical Skills:**

Students will learn to

1. Apply appropriate mathematical techniques to solve physics problems.
2. Apply appropriate techniques to study practical problems.

- **Tranferable skills:**

Students will be able to:

- Learn to think more creative as well as comparatively.
- Apply logical analysis to problem solving;
- Contribute to the management of a group engaged in project work
- Prepare and deliver a presentation and report of group work.
- Apply team-working skills to address a complex physics problem and contribute significantly to the work of a group tackling such a problem

Paper Name: Electronics

Class: M.Sc.(Physics) Semester: 1st

Objectives of the Courses:

1. The major objective of the course is to develop a better understanding of semiconductor physics. .
2. To cultivate skills at formulating and solving physics problems.
3. To develop familiarity with the physical concepts and to understand how a circuit works.
4. Provide the student with different practical, intellectual and transferable skills.
5. Use the tools, methodologies, language and conventions of physics to test and communicate ideas and explanations

Course Outcomes:

- **Knowledge and Understanding:**
- Basics of Semiconductor Physics.
- Basics of Diode, Transistor, Op-Amp, MicroProcessor.
- Theory of Digital Circuits.
- A/D and D/A converter.

- **Intellectual (Cognitive/ Analytical) Skills:**

Students will be able to:

- Think critically about the theories of physics.
- Think critically about the contribution of various scientists in the electronic world.
- Think critically about the how does electronics contributes in our routine life.

.

- **Practical Skills:**

Students will learn to

  - Apply appropriate logic to solve problems related to electronics.
  - Apply appropriate techniques to study Logic gates.

- **Tranferable skills:**

Students will be able to:

- Learn to think more creative as well as comparatively.

- Apply logical analysis to problem solving;
- Contribute to the management of a group engaged in project work
- Prepare and deliver a presentation and report of group work**.**
- Apply team-working skills to address a complex physics problem and contribute significantly to the work of a group tackling such a problem

Paper Name: Mathematical Physics

Class: M.Sc. (Physics) Semester: 1st

Objectives of the Courses:

1. The major objective of the course is to develop a better understanding of different mathematical aspects of physics and how to tackle mathematical difficulties in Physics.
2. To cultivate skills at formulating and solving physics problems.
3. Provide the student with different practical, intellectual and transferable skills.
4. Use the tools, methodologies, language and conventions of physics to test and communicate ideas and explanations

Course Outcomes:

- **Knowledge and Understanding:**
- Fourier and Laplace Transform.
- Tensor Notations.
- Methods to solve differential equations.

- **Intellectual (Cognitive/ Analytical) Skills:**

Students will be able to:

- Think critically about the theories of physics.
- Think critically about the contribution of various scientists in the mathematical world.
- Think critically about the contribution of Euler's Equation in solving various problems.
- Think critically about the use of physics in our daily life.

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- **Practical Skills:**

Students will learn to

1. Apply appropriate mathematical techniques to solve physics problems.
2. Apply appropriate techniques to study practical problems.

- **Tranferable skills:**

Students will be able to:

- Learn to think more creative as well as comparatively.
- Apply logical analysis to problem solving;
- Contribute to the management of a group engaged in project work
- Prepare and deliver a presentation and report of group work.
- Apply team-working skills to address a complex physics problem and contribute significantly to the work of a group tackling such a problem

Paper Name: Computational Techniques

Class: M.Sc. (Physics) Semester: 1st

Objectives of the Courses:

1. The major objective of the course is to develop a better understanding of computational methods required to solve many physical problems.

2. To develop familiarity with a new language MATLAB and to understand how it works.

3. Provide the student with different practical, intellectual and transferable skills.

5. Use the tools, methodologies, language and conventions of physics to test and communicate ideas and explanations

Course Outcomes:

- **Knowledge and Understanding:**
- Basics of MATLAB.
- Basics of Interpolation Techniques.
- Techniques to solve differential equations.
- Methods to solve roots of the equation.

- **Intellectual (Cognitive/ Analytical) Skills:**

Students will be able to:

- Think critically about the theories of physics.
- Think critically about the contribution of various scientists in the Physical world.
- Think critically about the how does solving complex equations leads to various physical concepts.

.

- **Practical Skills:**

Students will learn to

  - Apply appropriate MATLAB code to solve problems related to mathematical problems.
  - Apply appropriate techniques to study MATLAB software.

- **Tranferable skills:**

Students will be able to:

- Learn to think more creative as well as comparatively.

- Apply logical analysis to problem solving;
- Contribute to the management of a group engaged in project work
- Prepare and deliver a presentation and report of group work**.**

  Apply team-working skills to address a complex physics problem and contribute significantly to the work of a group tackling such a problem.

Paper Name: Electrodynamics-II

Class: M.Sc. (Physics) Semester: 3rd

Objectives of the Course:

1. The major objective of the course is to make the students familiar with the vast implications of Electricity and Magnetism

2. To cultivate skills at formulating and solving physics problems.

3. To develop familiarity with the physical concepts and mathematical methods of electrodynamics.

Course Outcomes:

A. Knowledge and Understanding:

Students will:

- Know how to define Electrostatics and Electrodynamics.
- Understand how a wave propagates in wave guides.
- Understand relativistic formulation of electrodynamics.
- To understand the theory of field of moving charges.

B. Intellectual (Cognitive/ Analytical) Skills:

Students will be able to:

- Think critically about the theories of physics.
- Think critically about the contribution of various scientists in the field of electrodynamics.
- Understand that how a charge on single electron does plays a crucial role in understanding the world of current and magnetism.
- Think critically about the wave particle duality nature.
- Think critically about the use of physics in our daily life.

- Think critically about how electricity and magnetism plays a crucial role in day to day life.
- Think critically about how electromagnetic wave theory plays an important role in telecommunication.

C. <u>Tranferable skills</u>:

Students will be able to:

- Use concepts of physics more effectively.
- Learn to think more creative as well as comparatively.
- Project planning.
- Problem solving