

**KONGUNADU ARTS AND SCIENCE COLLEGE**  
**(AUTONOMOUS)**  
**COIMBATORE – 641029**

*Re-accredited by NAAC with 'A<sup>+</sup>' Grade (4<sup>th</sup> Cycle)*

*College of Excellence (UGC) Coimbatore – 641 029*



**DEPARTMENT OF PHYSICS (PG)**

**COURSE OUTCOME(CO)**

**M.Sc. PHYSICS**

**For the Students admitted in the Academic year 2022-2023**

**Sub. Code:2PPH101**

<b>Programme code : 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Core Paper 1 – Classical Mechanics</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semester</b> <b>1</b>	<b>Hours/Week</b> <b>5</b>	<b>Total Hours</b> <b>75</b>	<b>Credits</b> <b>4</b>

**Course Objectives**

To enable the learners to know about the

1. Mechanics of single and system of particle
2. Generalized coordinates, Lagrangian formulation and mechanics of rigid body motion
3. Hamiltonian formulation of mechanics, Hamilton-Jacobi theory, harmonic oscillator problem, theory and applications of small oscillations.

**Course outcomes (CO)**

<b>K1 to K5</b>	<b>CO1</b>	Know about Newtonian mechanics
	<b>CO2</b>	Gain knowledge about Lagrangian formulation
	<b>CO3</b>	Acquire knowledge about mechanics of rigid body motion.
	<b>CO4</b>	Know about Hamiltonian formulation

**Sub. Code: 22PPH102**

<b>Programme code : 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Core Paper 2 - Mathematical Physics</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semester</b> <b>1</b>	<b>Hours/Week</b> <b>5</b>	<b>Total Hours</b> <b>75</b>	<b>Credits</b> <b>4</b>

**Course Objectives**

To enable the learners

1. Understand complex variables, group theory & tensors
2. Know about types of differential equations in Physics
3. Study about numerical methods

**Course outcomes (CO)**

<b>K1 to K5</b>	<b>CO1</b>	Understanding of complex analysis including important theorems and determination of residues to evaluate definite integrals
	<b>CO2</b>	Solve partial differential equations and be familiar with special functions such as Bessel, Legendre and Hermite
	<b>CO3</b>	Have knowledge in abstract group theory and tensors
	<b>CO4</b>	Understand partial differential equations in Physics
	<b>CO5</b>	Apply numerical methods to obtain appropriate solutions to mathematical problems

**Sub. Code: 22PPH103**

Programme code : 03		M.Sc. Physics		
Title of the Paper		Core Paper 3 – Condensed Matter Physics I		
Batch 2022-2023	Semester 1	Hours/Week 5	Total Hours 75	Credits 4

### Course Objectives

To enable the learners to

1. Understand the crystal system of materials
2. Know about crystal imperfection and lattice vibrations
3. Study about lattice and electronic specific heat

### Course outcomes (CO)

<b>K1 to K5</b>	<b>CO1</b>	Understand the crystal structure and reciprocal lattice
	<b>CO2</b>	Understand the crystal structure by XRD
	<b>CO3</b>	Gain knowledge about crystal imperfection
	<b>CO4</b>	Acquire knowledge on lattice vibrations and thermal properties
	<b>CO5</b>	Acquire knowledge about lattice and electronic specific heat

**Sub. Code: 22PPH204**

Programme code : 03		M.Sc. Physics		
Title of the Paper		Core Paper 4 – Quantum Mechanics I		
Batch 2022-2023	Semester 2	Hours/Week 5	Total Hours 75	Credits 4

### Course Objectives

To enable the learners to

1. Gain knowledge on General formalism of quantum mechanics
2. Gain knowledge on energy Eigenvalue problems, angular momentum and approximation methods
3. Understand time dependent, time independent and perturbation theories.

### Course Outcomes (CO)

<b>K1 to K5</b>	<b>CO1</b>	Knowledge on General formalism of quantum mechanics
	<b>CO2</b>	Knowledge on one and three dimensional energy Eigenvalue problems
	<b>CO3</b>	Knowledge on energy angular momentum
	<b>CO4</b>	Acquire knowledge on time independent quantum approximation Methods
	<b>CO5</b>	Understand time dependent perturbation theory and semi-classical treatment of radiation

**Sub. Code: 22PPH205**

Programme code : 03		M.Sc. Physics		
Title of the Paper		Core Paper 5 - Thermodynamics and Statistical Mechanics		
Batch	Semester	Hours/Week	Total Hours	Credits
2022-2023	2	5	75	4

**Course Objectives**

To enable the learners to know about

1. Thermodynamics and ensembles
2. Classical distribution law and quantum statistics
3. Application of quantum statistics.

**Course outcomes (CO)**

<b>K1 to K5</b>	<b>CO1</b>	Know about thermodynamics and radiations
	<b>CO2</b>	Acquire knowledge on ensembles
	<b>CO3</b>	Get knowledge about classical distribution law
	<b>CO4</b>	Get knowledge about quantum statistics
	<b>CO5</b>	Understand applications of quantum statistics

**Sub.Code: 22PPH306**

Programme code : 03		M.Sc. Physics		
Title of the Paper		Core Paper-6 Thin Film Physics, Plasma Physics and Crystal Growth		
Batch	Semester	Hours/Week	Total Hours	Credits
2022-2023	3	5	75	4

**Course Objectives**

To enable the learners to

1. Understand the preparation and characterization of thin films
2. Understand the fundamentals of plasma Physics
3. Acquire knowledge about crystal growth techniques

**Course outcomes (CO)**

<b>K1 to K5</b>	<b>CO1</b>	Understand the principles, advantages and disadvantages of different thin film deposition methods
	<b>CO2</b>	Understand the growth mechanism of thin films
	<b>CO3</b>	Understand the fundamentals of plasma
	<b>CO4</b>	Can distinguish single particle approach and fluid approach
	<b>CO5</b>	Understand different crystal growth techniques

**Sub. Code: 22PPH307**

Programme: 03		M.Sc. Physics		
Title of the Paper		Core Paper 7 - Quantum Mechanics II		
Batch 2022-2023	Semester 3	Hours/Week 5	Total Hours 75	Credits 4

### Course Objectives

To enable the learners to

1. Understand the basic approximate methods in molecular quantum mechanics
2. Understand relativistic quantum theory, quantum optics
3. Understand quantization of fields and scattering

### Course outcomes (CO)

<b>K1 to K5</b>	<b>CO1</b>	Understand different approximations and models to describe a many electron system
	<b>CO2</b>	Comparison of MO and VB theories to explain molecular structure of hydrogen molecule and hydrogen ion
	<b>CO3</b>	Understand relativistic quantum mechanics
	<b>CO4</b>	Acquire knowledge on quantum field theory
	<b>CO5</b>	Interpret scattering theory in terms of quantum aspects.

**Sub. Code: 22PPH308**

Programme: 03		M.Sc. Physics		
Title of the Paper		Core Paper 8 – Electromagnetic Theory and Electrodynamics		
Batch 2022-2023	Semester 3	Hours/Week 5	Total Hours 75	Credits 4

### Course Objectives

To enable the learners

1. Electrostatics and magnetostatics
2. Applications of Maxwell's equations
3. Antenna arrays

### Course outcomes (CO)

<b>K1 to K5</b>	<b>CO1</b>	Understand electrostatics and magnetostatics
	<b>CO2</b>	Acquire knowledge on field equations and conservation laws
	<b>CO3</b>	Understand the propagation of electromagnetic waves in different media on microscopic scale
	<b>CO4</b>	Study the interaction of electromagnetic waves with different media on macroscopic scale
	<b>CO5</b>	Acquire knowledge on relativistic electrodynamics

**Sub. Code: 22PPH309**

<b>Programme: 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Core Paper 9 – Condensed Matter Physics II</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semester</b> <b>3</b>	<b>Hours/Week</b> <b>4</b>	<b>Total Hours</b> <b>60</b>	<b>Credits</b> <b>4</b>

**Course Objectives**

To gain knowledge about

1. Band theory of solids
2. Semiconductors, dielectrics and ferroelectrics
3. Magnetism and superconductors

**Course Outcomes (CO)**

<b>K1 to K5</b>	<b>CO1</b>	Knowledge on band theory of solids
	<b>CO2</b>	Understand semiconductors
	<b>CO3</b>	Acquire knowledge on superconductors
	<b>CO4</b>	Gain knowledge on dielectrics and ferroelectric materials
	<b>CO5</b>	Acquire knowledge on magnetism

**Sub. Code: 22PPH410**

<b>Programme: 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Core Paper 10 - Problems in Physics</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semester</b> <b>4</b>	<b>Hours/Week</b> <b>5</b>	<b>Total Hours</b> <b>75</b>	<b>Credits</b> <b>4</b>

**Course Objectives**

To enable the learners to

1. Acquire knowledge and skills to solve problem through the concept behind physics
2. Apply creative thinking techniques towards realistic problem
3. Visualize the basic concepts clearly

**Course outcomes (CO)**

<b>K1 to K5</b>	<b>CO1</b>	Understand and solve problems in classical mechanics
	<b>CO2</b>	Understand and solve problems in quantum mechanics
	<b>CO3</b>	Understand and solve problems in electromagnetics
	<b>CO4</b>	Understand and solve problems in electronics
	<b>CO5</b>	Understand and solve problems in thermodynamics and statistical Physics

**Sub. Code: 22PPH411**

<b>Programme: 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Core Paper 11 - Atomic and Molecular Spectroscopy</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semester</b> <b>4</b>	<b>Hours/Week</b> <b>6</b>	<b>Total Hours</b> <b>90</b>	<b>Credits</b> <b>4</b>

**Course Objectives**

To enable the learners to

1. Understand atomic, microwave and IR spectroscopy
2. Know about Raman, NMR and NQR spectroscopy
3. Know about ESR and Mossbauer spectroscopy

**Course outcomes (CO)**

<b>K1 to K5</b>	<b>CO1</b>	Understand atomic spectroscopy
	<b>CO2</b>	Gain knowledge on microwave and IR spectroscopy
	<b>CO3</b>	Acquire knowledge on Raman spectroscopy
	<b>CO4</b>	Understand NMR and NQR spectroscopy
	<b>CO5</b>	Acquire knowledge on ESR and Mossbauer spectroscopy

**Sub. Code: 22PPH412**

<b>Programme code : 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Core Paper 12 - Nuclear and Particle Physics</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semester</b> <b>4</b>	<b>Hours/Week</b> <b>5</b>	<b>Total Hours</b> <b>75</b>	<b>Credits</b> <b>4</b>

**Course Objectives**

To enable the learners to

1. Know about radioactivity
2. Gain knowledge on Alpha and Beta particles and Gamma rays
3. Understand nuclear models and particle Physics

**Course Outcomes (CO)**

<b>K1 to K5</b>	<b>CO1</b>	Study the phenomenon of radioactivity
	<b>CO2</b>	Understand Alpha and Beta particles and Gamma rays
	<b>CO3</b>	Gain knowledge on nuclear properties
	<b>CO4</b>	Acquire knowledge on nuclear models
	<b>CO5</b>	Gain knowledge on elementary particles

**Sub. Code: 22PPH2CL**

Programme code : 03		M.Sc. Physics		
Title of the Paper		Core Practical I – General Experiments		
Batch 2022-2023	Semesters 1 & 2	Hours/Week 5	Total Hours 150	Credits 5

**Course Objectives**

To enable the learners

1. Perform experiments in the field of general Physics
2. Explain physical phenomena and enable to relate physical laws and their applications
3. Apply standard techniques and analyze the experimental results and output.

**Course outcomes (CO)**

<b>K3,K4,K5</b>	<b>CO1</b>	Have a foundation in fundamentals and applications of general Physics
	<b>CO2</b>	Able to design, carry out record and analyze experimental data.
	<b>CO3</b>	Provide hands on experiences in conducting laboratory experiments.
	<b>CO4</b>	Understand the relationship between theory and experimental results.
	<b>CO5</b>	Practice record keeping of experimental work and data graphing.

**Sub. Code: 22PPH2CM**

Programme code : 03		M.Sc. Physics		
Title of the Paper		Core Practical II – Electronics Experiments		
Batch 2022-2023	Semesters 1 & 2	Hours/Week 5	Total Hours 150	Credits 4

**Course Objectives**

To enable the learners

1. Design and construct electronic circuits
2. Develop experimental skills and understand relation between experimental data and theoretical analysis.
3. Have a foundation in the fundamentals and applications of experimental Physics.

**Course outcomes (CO)**

<b>K3,K4,K5</b>	<b>CO1</b>	Acquire a basic knowledge in solid state electronics
	<b>CO2</b>	Analyse and design analog electronic circuits using discrete components.
	<b>CO3</b>	Observe the amplitude / frequency response of amplifiers.
	<b>CO4</b>	Take measurements to compare experimental results in the laboratory with the theoretical analysis.
	<b>CO5</b>	Practice record keeping of experimental work and data graphing.



**Sub. Code: 22PPH4CN**

<b>Programme: 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Core Practical III – Advanced Experiments</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semesters</b> <b>3 &amp; 4</b>	<b>Hours/Week</b> <b>5</b>	<b>Total Hours</b> <b>150</b>	<b>Credits</b> <b>5</b>

**Course Objectives**

**To enable the learners to**

1. Perform experiments in the field of advanced Physics and interpret the results.
2. Explain physical phenomena and enable to estimate various related parameters and to analyze them.
3. Apply the experimental techniques to research level.

**Course outcomes (CO)**

<b>K3,K4,K5</b>	<b>CO1</b>	Gain fundamental knowledge on applications of advanced Physics.
	<b>CO2</b>	Understand the relationship between theory and experiments
	<b>CO3</b>	Provide hands on experiences in conducting scientific investigations
	<b>CO4</b>	Provide hands on experiences in conducting laboratory experiments.
	<b>CO5</b>	Recording and analyzing experimental data.

**Sub. Code: 22PPH4CO**

<b>Programme: 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Core Practical IV – Special Electronic Experiments</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semesters</b> <b>3 &amp; 4</b>	<b>Hours/Week</b> <b>5</b>	<b>Total Hours</b> <b>150</b>	<b>Credits</b> <b>4</b>

**Course Objectives**

**To enable the learners to**

1. Design and construct special electronic circuits
2. Develop experimental skills and understand relation between experimental data and theoretical analysis.
3. Have a foundation in the fundamentals and applications of experimental Physics.

**Course outcomes (CO)**

<b>K3,K4,K5</b>	<b>CO1</b>	Acquire knowledge in solid state electronics
	<b>CO2</b>	Develop the ability to construct electronic circuits using discrete components.
	<b>CO3</b>	Acquire knowledge to construct Op. amp based circuits
	<b>CO4</b>	Acquire knowledge to construct microprocessor based circuits
	<b>CO5</b>	Understand the relation between theory and experiments

<b>Programme code : 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Major Elective Paper - Electronics and Microprocessor</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semester</b> <b>1 / 2</b>	<b>Hours/Week</b> <b>5</b>	<b>Total Hours</b> <b>75</b>	<b>Credits</b> <b>5</b>

### Course Objectives

To enable the learners to

1. Know about power electronics, operational amplifiers and non-linear integrated circuits
2. Understand architecture of microprocessors
3. Know about peripheral devices, interfacing and data acquisition systems.

### Course Outcomes (CO)

<b>K1 to K5</b>	<b>CO1</b>	Understand power electronics
	<b>CO2</b>	Gain knowledge on operational amplifiers and non-linear integrated Circuits
	<b>CO3</b>	Understand architecture of microprocessors
	<b>CO4</b>	Know about peripheral devices and interfacing
	<b>CO5</b>	Know about data acquisition systems

<b>Programme: 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Major Elective Paper - Communication Physics</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semester</b> <b>1/2</b>	<b>Hours/Week</b> <b>5</b>	<b>Total Hours</b> <b>75</b>	<b>Credits</b> <b>5</b>

### Course Objectives

To enable the learners to

1. Understand various modulation and detection techniques
2. Acquire knowledge about antennas and wave propagation
3. Understand generation and propagation of microwaves
4. Acquire knowledge on radar and communication electronics

### Course Outcomes (CO)

<b>K1 to K5</b>	<b>CO1</b>	Understand the concept of modulation and demodulation
	<b>CO2</b>	Understand the principle of antennas and wave propagation
	<b>CO3</b>	Knowledge on television and radar
	<b>CO4</b>	Acquire knowledge on communication electronics
	<b>CO5</b>	Understand microwave generation

<b>Programme code : 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Major Elective Paper - Energy Physics</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semester</b> <b>1 / 2</b>	<b>Hours/Week</b> <b>5</b>	<b>Total Hours</b> <b>75</b>	<b>Credits</b> <b>5</b>

#### **Course Objectives**

To enable the learners to

1. Know about Solar thermal and photovoltaic energy
2. Understand hydrogen energy, wind energy and ocean thermal energy
3. Understand energy auditing and carbon credits.

#### **Course Outcomes (CO)**

<b>K1 to K5</b>	<b>CO1</b>	Understand Solar thermal energy
	<b>CO2</b>	Gain knowledge on solar photovoltaic energy
	<b>CO3</b>	Understand wind and ocean thermal energy
	<b>CO4</b>	Know about Hydrogen energy and Fuel cells
	<b>CO5</b>	Understand energy auditing and carbon credits

<b>Programme code : 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Major Elective Paper - Industrial Physics</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semester</b> <b>1 / 2</b>	<b>Hours/Week</b> <b>5</b>	<b>Total Hours</b> <b>75</b>	<b>Credits</b> <b>5</b>

#### **Course Objectives**

To enable the learners to

1. Understand power electronic devices
2. Understand voltage regulators, switching and counting circuits
3. Understand industrial heating system and production of vacuum

#### **Course Outcomes (CO)**

<b>K1 to K5</b>	<b>CO1</b>	Understand power electronic devices
	<b>CO2</b>	Understand voltage regulators
	<b>CO3</b>	Gain knowledge on switching and counting circuits
	<b>CO4</b>	Know about industrial heating system
	<b>CO 5</b>	Acquire knowledge on production of vacuum

<b>Programme code : 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Major Elective Paper – Photovoltaic Science</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semester</b> <b>1 / 2</b>	<b>Hours/Week</b> <b>5</b>	<b>Total Hours</b> <b>75</b>	<b>Credits</b> <b>5</b>

### Course Objectives

To enable the learners to

1. Understand the science behind photovoltaics
2. Understand the classification of solar cells
3. Understand the characterization of silicon and dye sensitized solar cells

### Course Outcomes (CO)

<b>K1 to K5</b>	<b>CO1</b>	Explain Photovoltaic and solar cell
	<b>CO2</b>	Understand the basics about semiconductors
	<b>CO3</b>	Classification of amorphous silicon solar cell
	<b>CO4</b>	Construction and working of solar cells and Thin film fabrication methods.
	<b>CO 5</b>	Know about preparation and mechanism of dye sensitized solar cell.

<b>Programme code : 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Major Elective Paper – Problems in Physics I</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semester</b> <b>1 / 2</b>	<b>Hours/Week</b> <b>5</b>	<b>Total Hours</b> <b>75</b>	<b>Credits</b> <b>5</b>

**(Only problems which are specified should be asked under all sections in the question paper. No theory questions should be asked.)**

### Course Objectives

To enable the learners to

1. Acquire knowledge and skills to solve problem through the concept behind physics
2. Apply creative thinking techniques towards realistic problem
3. Visualize the basic concepts clearly

### Course Outcomes (CO)

<b>K1 to K5</b>	<b>CO1</b>	Understand and solve problems in mathematical methods in physics
	<b>CO2</b>	Understand and solve problems in experimental techniques and data analysis
	<b>CO3</b>	Understand and solve problems in atomic and molecular physics
	<b>CO4</b>	Understand and solve problems in condensed matter physics
	<b>CO 5</b>	Understand and solve problems in nuclear and particle physics

<b>Programme code : 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Major Elective Paper – Semiconductor Devices</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semester</b> <b>1 / 2</b>	<b>Hours/Week</b> <b>5</b>	<b>Total Hours</b> <b>75</b>	<b>Credits</b> <b>5</b>

Course Objectives

To enable the learners to

1. Impart knowledge on application of semiconducting materials
2. Understand the photolithography and etching processes
3. Impart knowledge on IC manufacturing

Course Outcomes (CO)

<b>K1 to K5</b>	<b>CO1</b>	Understand silicon oxidation process
	<b>CO2</b>	Understand photolithography
	<b>CO3</b>	Gain knowledge on different etching processes
	<b>CO4</b>	Know about ion implantation
	<b>CO 5</b>	Acquire knowledge on production of ICs

<b>Programme code : 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Major Elective Paper – Modern Optics</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semester</b> <b>1 / 2</b>	<b>Hours/Week</b> <b>5</b>	<b>Total Hours</b> <b>75</b>	<b>Credits</b> <b>5</b>

Course Objectives

To enable the learners to

1. Understanding necessary and sufficient condition for laser
2. Understanding basic principles involved in Non-linear optical effects
3. Understanding different types of optical fibers and its applications

Course Outcomes (CO)

<b>K1 to K5</b>	<b>CO1</b>	Understand polarization and optics of solids
	<b>CO2</b>	Understand laser action
	<b>CO3</b>	Gain knowledge about non-linear optics and its applications
	<b>CO4</b>	Know about construction of optical fibers
	<b>CO 5</b>	Acquire knowledge on applications of optical fibers

<b>Programme: 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Non Major Elective Paper – Nanotechnology : Principles and Applications</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semester</b> <b>3</b>	<b>Hours/Week</b> <b>4</b>	<b>Total Hours</b> <b>60</b>	<b>Credits</b> <b>4</b>

### Course Objectives

To enable the learners to

1. Understand the concepts in nanomaterials
2. know about different synthesis processes of nanomaterials
3. know about characterization techniques and applications of nanomaterials

### Course Outcomes (CO)

<b>K1 to K5</b>	<b>CO1</b>	Understand the concepts in nanomaterials
	<b>CO2</b>	Know the synthesis methods of 0-D, 1-D, 2-D and 3-D nanomaterials
	<b>CO3</b>	Know the various characterization methods
	<b>CO4</b>	Gain knowledge on properties of nanomaterials
	<b>CO5</b>	Understand the applications of nanomaterials

<b>Programme code : 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Non Major Elective Paper - Intellectual Property Rights</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semester</b> <b>3</b>	<b>Hours/Week</b> <b>4</b>	<b>Total Hours</b> <b>60</b>	<b>Credits</b> <b>4</b>

### Course Objectives

To enable the learners

1. Understand the aspects of Intellectual Property Rights
2. Know about Patents, Copyrights, Trademarks and Registration aspects
3. Know about Design and Geographical Indication of IPR

### Course outcomes (CO)

<b>K1 to K5</b>	<b>CO1</b>	Acquire knowledge about Intellectual Property Rights
	<b>CO2</b>	Understand about patents and patent registration
	<b>CO3</b>	Acquire knowledge on copyrights and registration
	<b>CO4</b>	Gain knowledge on trademarks and registration
	<b>CO5</b>	Understand the design and geographical indication of IPR

**Sub. Code: 22PGI4N2**

<b>Programme Code: 03</b>		<b>M.Sc Physics</b>		
<b>Title of the Paper</b>		<b>Non-Major Elective Paper: Information Security</b>		
<b>Batch 2022-2023</b>	<b>Semester 4</b>	<b>Hours/Week 4</b>	<b>Total Hours 60</b>	<b>Credits 4</b>

**Course Objectives**

1. Students will identify the core concepts of Information security.
2. To examine the concepts of Information Security.
3. To design and implement the security features for IT and Industrial sectors.

**Course Outcomes (CO)**

<b>K1 – K5</b>	<b>CO1</b>	To Learn the principles and fundamentals of information security.
	<b>CO2</b>	To Demonstrate the knowledge of Information security concepts
	<b>CO3</b>	To Understand about Information Security Architecture.
	<b>CO4</b>	To Analyze the various streams of security in IT and Industrial sector.
	<b>CO5</b>	To know about Cyber Laws and Regulations.

<b>Programme Code : 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>Non Major Elective Paper - Research Ethics</b>		
<b>Batch 2022-2023</b>	<b>Semester 4</b>	<b>Hours/Week 4</b>	<b>Total Hours 60</b>	<b>Credits 4</b>

**Course Objectives**

To enable the learners

1. To understand the philosophy of science and ethics,
2. To know about research integrity and publication ethics.
3. To understand indexing, citation databases and the usage of plagiarism tools.
4. At the end of the course the student will have awareness about the publication ethics and publication misconducts

**Course Outcomes (CO)**

<b>K1 - K5</b>	<b>CO1</b>	understand the philosophy of science and ethics, research integrity and publication ethics
	<b>CO2</b>	identify research misconduct and predatory publications
	<b>CO3</b>	Know about indexing and citation databases, open access publications, research metrics (citations, h-index, impact Factor, etc.)
	<b>CO4</b>	Understand the usage of plagiarism tools
	<b>CO5</b>	Gain knowledge on the publication ethics and publication misconducts

**Subject Code: 22PPH3X1**

<b>Programme: 03</b>		<b>M.Sc. Physics</b>		
<b>Title of the Paper</b>		<b>EDC - Biomedical Instrumentation</b>		
<b>Batch</b> <b>2022-2023</b>	<b>Semester</b> <b>3</b>	<b>Hours/Week</b> <b>2</b>	<b>Total Hours</b> <b>30</b>	<b>Credits</b> <b>2</b>

**Course Objective**

To enable the learners to

1. Gain knowledge on bioelectric signals and transducers
2. Understand blood gas analyzers, pulmonary function analyzers and Oximeters
3. Understand the modern imaging systems and electrical safety

**Course outcome (CO)**

<b>K1 to K5</b>	<b>CO1</b>	Gain knowledge on bioelectric signals and transducers
	<b>CO2</b>	Understand Blood gas analyzers, pulmonary function analyzers and Oximeters
	<b>CO3</b>	Acquire knowledge on blood cell counters and audiometer
	<b>CO4</b>	Acquire knowledge on bio-medical recorders
	<b>CO5</b>	Gain knowledge on modern imaging systems and electrical safety

<b>Programme: 03</b>	<b>M.Sc. Physics</b>
<b>Title of the Paper</b>	<b>ALC - Advanced Experimental Techniques</b>
<b>Batch</b>	<b>2022-2023</b>
<b>Extra Credits</b>	<b>2</b>

**Course Objective**

To enable the learners to

1. Understand different types of structural and surface morphological and spectroscopic characterization techniques
2. Gain knowledge about magnetic techniques
3. Understand thermal analytical techniques

**Course outcome (CO)**

<b>K1 to K5</b>	<b>CO1</b>	Gain knowledge on structural characterization
	<b>CO2</b>	Acquire knowledge on spectroscopic analysis
	<b>CO3</b>	Gain knowledge on morphological techniques
	<b>CO4</b>	Acquire knowledge on magnetic properties of materials
	<b>CO5</b>	Gain knowledge on thermal analytical techniques