# AQAR – QUALITATIVE METRIC

## 2022 - 2023

## Criterion 1 - Curricular Aspects

**1.1.1 Curricula developed and implemented have relevance to the local, national, regional and global developmental needs which is reflected in Programme outcomes (POs), Programme specific outcomes (PSOs) and Course Outcomes (COs), of the Programmes offered by the Institution.**

### Name of the Programme: M.SC PHYSICS

### Programme Outcomes

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| **PO1** | Gain exposure on the analysis and interpretation of mathematical models including the problems of physics |
| **PO2** | Promote experimental skills |
| **PO3** | Develop entrepreneurship and employability skills |

### Programme Specific Outcomes

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| **PSO1** | Acquire thorough knowledge of the basic concepts of the frontier areas of Physics comprising Mathematical Physics, Electromagnetic theory, Classical Mechanics, Quantum Mechanics, Condensed Matter Physics, Nuclear Physics, Numerical Methods, Communication systems, Molecular Spectroscopy, Material Science and Advanced Quantum Mechanics. |

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| **PSO2** | Understand and solve the physics problems in everyday life using the acquired basic knowledge. |
| **PSO3** | Develop skills to perform experiments based on the theoretical understanding |
| **PSO4** | Apply the knowledge acquired to analyse and design models in the versatile realm of physics |
| **PSO5** | Equip with the essential foundations for higher education and research in physics. |

## Course Outcomes

| Course Code | Course Title | Nature of the Course (Local/National/Regional/Global) | Course Description | Course Outcomes |
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| 19PG1P1 | Introduction To Mathematical Physics | National | This course emphasises the basic concepts and applications of Mathematical Physics | CO1. Students will be able to define and deduce gauss divergence and stokes theorem and solving problems on gauss |

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| | | | which involves vectors, matrices, integral transforms and special functions | divergence and stokes theorem<br>CO2.Students will be able to Discuss orthogonal curvilinear coordinates and spherical polar coordinates and solving problems using these coordinates<br>CO3.Students will be able to Explain special type of matrices and its Eigen value problems and illustrate the properties of Fourier and Laplace transforms<br>CO4.Students will be able to Define Beta and Gamma Functions and find its relations |

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| | | | | CO5.Students will be able to Define Gamma Functions and find its relations |
| 19PG1P2 | Applied Electronics | Global | This course aims to introduce applied electronics to students, encompassing the concepts of semiconductor diode characteristics, Op-Amp characteristics, registers, counters, and analog to digital conversion techniques. | CO1. Students will be able to distinguish between BJT and FET<br>CO2. Students will be able to explain the fundamental concepts of diode, BJT and transistor biasing to understand the small signal behaviour of FET for amplification applications<br>CO3. Students will be able to Outline the basics of linear and non linear systems<br>CO4. Students will be able to describe the design concept |

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| | | | | of counters and shift registers<br>CO5. Students will be able to apply the theory of OPAMP to design the linear non linear applications of it |
| 19PG1P3 | Classical Mechanics | Global | This course imparts a thorough knowledge of Mechanics of single particle and a system of particles, applying various classical theories. This would help them to analyse any system using classical mechanics. | CO1. Students will be able identify different types of constraints imposed on systems<br>CO2. Students will be able derive Lagrange's equation from Hamilton's variational principle and to write the equation of motion for any given system according to Lagrangian formulation.<br>CO3. Students will be able |

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| | | | | explain the two body central force problem and classification of orbits and hence to discuss scattering in a central force field.<br>CO4. Students will be able apply the theory of small oscillations to a linear triatomic molecule and get the normal modes and normal frequencies of te same.<br>CO5. Students will be able derive Hamiltonh's equations using Legendre transformation. To evaluate the connection between conservation theorems and |

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| | | | | symmetry properties of the system. To solve problems related to canonical transformations and Poisson brackets |
| 21PG1P4 | Applied Optics | National | The course provides an overview of the fields of laser, nonlinear optics, Fourier optics and holography. | CO1: Students will be able to Understand and explain the properties of Laser beams and types of lasers<br>CO2 : Students will be able to Describe the basic concepts of nonlinear optics and principles of second harmonic generation and optical mixing<br>CO3. Students will be able to Acquire knowledge about the techniques of Fourier optics inclusive of diffraction |

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| | | | | CO4.Students will be able to Understand the fundamentals of optical signal processing and its techniques of analysis<br>CO5.Students will be able to Describe the principles and practical problems of holography . |
| 19PG1P5 | Practicals-I (Non-Electronics) | National | The course provides hands on training to work with fiber, Laser and determination of the young's modulus, mutual inductance. | Students will be able to handle the laboratory equipment's and develop lab skills in non-electronics experiments |
| 19PG1P6 | Practicals-I (Electronics) | National | The course provides hands on training to work with counters, multivibrators and | Students will be able to handle the laboratory equipment's and develop lab skills in electronics experiments. |

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| | | | OP-AMP circuits, flip flops and microprocessor | |
| 19PG2P7 | Advanced Mathematical Physics | National | This course emphasise the basic concepts and applications of Mathematical Physics which involves complex variables, tensors, Dirac delta, Greens function and group theory | CO1.Students will be able to Perform algebra with complex numbers and to Identify and determine the differentiable functions and find its derivatives<br>CO2. Students will be able to<br>Identify the singularities of a function and determine whether they are removable poles are essential<br>CO3. Students will be able to<br>Perform algebra of tensors and apply four vectors in |

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| | | | | special relativity and the formulation of electrodynamics<br>CO4. Students will be able to<br>Discuss greens function for Sturn – Liouville operator and to compute dirac delta functions Green's functions and solving problems<br>CO5. Students will be able to<br>Represent delta function and apply delta calculus |
| 19PG2P8 | Quantum Mechanics | National | This course introduces Schrodinger equation, general formalism of quantum mechanics, | CO1. Students will be able to analyze the inadequacy of Classical mechanics to explain black body radiation, photoelectric effect, specific |

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| | | | exactly soluble Eigen value problems , representations and angular momentum. | heat of solids and Compton effect.<br>CO2. Students will be able to discuss the basic postulates of Quantum mechanics.<br>CO3. Students will be able to explain the general formalism of wave function and to write the Schrodinger's equation and obtain the Eigen values and Eigen functions of a particle in a square potential well; To discuss the problem of barrier penetration.<br>CO4. Students will be able to solve the problem of Simple harmonic oscillator by |

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| | | | | Schrodinger's method and also by abstract operator method.<br>CO5. Students will be able to compare Schrodinger's notation with Dirac notation and to discuss the representation of state vectors and operators. |
| 19PG2P9 | Electromagnetic Theory | National | The purpose of this course is to provide the methods to analyse and understand the static electric field, the static magnetic field, and electromagnetic wave propagation. The | CO1. Students will be able to Gain insight about the electric field and their charge distribution at various condition such as in static and moving fields<br>CO2. Students will be able to Cultivate knowledge in dealing with the static |

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| | | | course provides a basic knowledge of fundamental principles behind Electromagnetic Theories and Phenomena. | electric field in dielectric media and their elaborated parameter study.<br>CO3. Students will be able to Develop thorough knowledge of static and moving magnetic fields of steady current and charged particles.<br>CO4. Students will be able to Detailed understanding of time dependent electric and magnetic fields and their wave propagation properties.<br>CO5. Students will be able to Acquire essential knowledge in circuitry in transmission lines and wave guides and a |

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| | | | | detailed study about antenna. |
| 21PG2P10 | Instrumentation and Microcontroller | National | This course introduces the physics of various transducers inclusive of resistive, inductive, capacitive, optical, digital and electrochemical transducers architecture of 8051 Microcontroller used in measurement systems. | CO1. Students will be able to understand the basic knowledge on various resistive transducers<br>CO2. Students will be able to discuss the physics behind inductive and capacitive transducer<br>CO3. Students will be able to comprehend the working principle behind the various optical,mechanical , digital and electrochemical transducers.<br>CO4.Students will be able to assess and describe the basic properties and architecture of 8051 Microcontroller |

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| | | | | CO5. Students will be able to solve basic arithmetic operations and perform the necessary programming for it. |
| 19PG2P11 | Practicals (Non-Electronics) | National | The course provides hands on training to work with Four Probe method, Prism, Grating and Quinke's method. | Students will be able to handle the laboratory equipment's and develop lab skills innon-electronics experiments. |
| 19PG2P12 | Practicals (Electronics) | National | The course provides hands on training to work with counters, multivibrators and OP-AMP circuits, flip flops and microprocessor | Students will be ale to handle the laboratory equipment's and develop lab skills in electronics experiments. |

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| 19PG3P11 | Condensed Matter Physics | Global | The objective of this course is to understand the structure and properties of solid state materials<br>. | CO1. Students will be able to Explain Fourier analysis of crystals and compute the structure factor - Discuss the various types of crystal binding<br>CO2. Students will be able to Discuss quantization of elastic waves in lattice vibrations<br>CO3. Students will be able to Analyze the thermal properties of solids by applying different models<br>CO4. Students will be able to Discuss the Kronig-Penney model and its implications<br>CO5. Students will be able to Explain Fermi surfaces and determine the same by De Haas |

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| | | | | van Alphen effect |
| 19PG3P12 | Statistical Mechanics | National | This course develops concepts in Classical statistical mechanics, Quantum statistics, fluctuations and one dimensional random walk. | CO1. Students will be able toAnalyse classical equilibrium thermodynamics to make physical predictions, describe the effects of quantum mechanics on statistical mechanics<br>CO2. Students will be able to Acquire knowledge on Canonical and Grand canonical ensembles.<br>CO3. Students will be able to Understand the concepts of Bose Einstein condensation.<br>CO4. Students will be able to Apply statistical mechanics to condensed matter systems |

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| | | | | such as Fermi gases, white dwarfs and nuclear matter.<br>CO 5. Students will be able to Compute fluctuations in the systems of canonical, micro canonical and grand canonical ensembles and comprehend random process using Fourier analysis |
| 19PG3P13 | Nuclear and Particle Physics | National | The aim of this course is to provide an overview of the fields of nuclear and particle physics | CO1. Students will be able to understand range of alpha particles, spectra and Gamow's theory of alpha decay. And to describe Fermi's theory of Beta decay.<br>CO2. Students will be able to Describe nuclear energy sources<br>CO3. Students will be able to |

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| | | | | Explain various nuclear models<br>CO4. Students will be able to Describe nuclear reactions and solve some problems related to cross section<br>CO5. Students will be able to Classify the elementary particles and explain their various properties |
| 19PG3P14 | Practicals V (Advanced Non Electronics) | National | The lab course deals with Advanced General Experiments in Physics | Students will experience conceptual understanding of electrical, magnetic, optical and magneto-opticproperties of materials, propagation of Ultrasonic waves through liquids, lattice parameters of crystals, principle and efficiency of solar water heater, properties |

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| | | | | of polarized light |
| 19PG3P15 | Practicals VI (Advanced Electronics) | National | This course gives an opportunity to understand the characteristics and applications of Electronic devises like Op- Amp, Photo diode, FET, UJT, SCR, Klystron, Micro controller and Transmission line. | Students will be able to use the various electronic devises for various applications. Also the student is exposed to Mathematica –Wolfram language and Wolfram cloud to plot simple functions. |
| 19PG4P16 | Advanced Condensed Matter Physics | National | The objective of this course is to understand in depth the physics of the properties of metals, | CO1. Students will be able to Analyse the dispersion of electromagnetic waves in a non-magnetic solid<br>CO2. Students will be able to |

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| | | | superconductors, dielectrics and magnetic solids | Identify lattice vacancies and defects and explain the color centers in crystals Compare the behaviour of normal conductor and superconductor Explain superconductivity based on various models and theories<br>CO3. Students will be able to Identify dielectric medium and analyze their polarization properties.<br>CO 4. Students will be able to Apply quantum theory and analyze the magnetisation and susceptibility properties<br>CO5. Students will be able to Discuss the formation of plasmons, polaritons, polarons |

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| | | | | and excitons and their interactions with the solids. |
| 19PG4P17 | Molecular Spectroscopy | National | This course imparts a thorough knowledge of spectroscopic methods of the different regions of the electromagnetic spectrum and the techniques available for the understanding of molecular structure, nature of bonding, molecular symmetry and inter and intra molecular interactions. This would help them to | CO1. Students will be able to identify the various interactions of radiation with matter and the corresponding regions in the electromagnetic spectrum.<br>CO 2. Students will be able to derive the relationship between molecular spectra and molecular properties<br>CO 3. To explain Microwave , Spin Resonance, Infra Red, Raman , Electronic and NMR spectra and the associated techniques and instrumentation.<br>CO4. Students will be able to |

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| | | | analyse any substance from the informations obtained through various spectroscopic techniques. | apply the theory to understand molecular spectra<br>CO5. Students will be able to a derive Bloch equations. |
| 19PG4P18 | Advanced Quantum Mechanics | National | This course deals with the approximation methods for stationary states, evolution of time concepts, scattering theory and relativistic quantum mechanics. | CO1. Students will be able to understand perturbation theory and Solve quantum mechanical problems using variation method<br>CO 2. Students will be able to Solve one dimension Schrödinger equation using WKB approximation method<br>CO3. Students will be able to Explain about dipole |

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| | | | | approximation, harmonic perturbation, Fermi's Golden rule<br>CO4. Students will be able to Understand partial wave analysis techniques<br>CO5. Students will be able to Solve the problems using relativistic equations |
| 19PG4P19 | Practicals VII<br>Physics of General Experiments | National | The lab course provides hands on experience in Advanced General Experiments in Physics. | Students will be able to deals with electric, magnetic, optic and electromagnetic behaviour of materials,propagation of Ultrasonic waves through liquids, microwave characteristics |
| 19PG4P20 | Practicals VIII<br>PROGRAMMING IN C++ | National | The course deals with Computational | Students will be familiar the to apply numerical methods in |

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| | | | Programming skills. | modern scientific computing. |
| 19P1EDC/ 19P2EDC | Modern Photography | National | This course will familiarize the students with the fundamental techniques necessary for the creative use of photography by introducing them to the basic usage of SLR camera and Adobe Photoshop post processing. | CO1. Students will be able to Understand the basic phenomena of photography.<br>CO2.Students will be able to comprehend the basic parts of camera, its important control parameters and composition techniques of photography<br>CO3. Students will be able to handle SLR camera and apply various composition techniques and shoot professional photographs<br>CO4. Students will be able to understand the modern technique of photoshop and develop skills to manipulate, |

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| | | | | edit and enhance the real time photographs using photoshop.<br>CO5. Students will be able to prepare their own digital ids and greeting cards with photoshop |
| 19PG3PE1A | Communication Systems | National | This course introduces the types of analog and digital communication systems involving different modulation and coding schemes. Also it encompasses the fundamental concepts of satellite, fiberoptic communications and microwave generation. | CO1. Students will be able to Explain amplitude modulation techniques and sideband principles<br>CO2. Students will be able to Describe the concepts of angle modulation and compare frequency and phase modulation<br>CO3. Students will be able to Describe the key modules of digital *communication systems* with emphasis |

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| | | | | on...PAM, Pulse code modulation (PCM), DM<br>CO4. Students will be able to Deduce the fundamental laws of of satellite communication and explain the principle of optical fiber communication<br>CO5. Students will be able to Describe about basic, high frequency, microwave , wideband and special purpose antennas and principles of microwave generation. |
| 19PG3PE1B | Numerical Methods & Programming in C++ | National | The objective of this course is to enable the students to learn the various numerical methods to solve | CO 1. Students will be able to Solve Algebraic and Transcendental equations numerically using Regula Falsi and Newton Raphson method |

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| | | | algebraic & transcendental equations and also numerical differentiation and integration. Also it provides object oriented techniques to write programs in C++ especially for all the numerical methods | CO 2. Students will be able to Apply newton's forward and backward interpolation formulae to equal and unequal intervals<br>CO3. Students will be able to Evaluate numerical differentiation and integration<br>CO4. Students will be able to Compose C++ program using structures and classes and apply inheritance and polymorphism features in C++ programming.<br>CO5.Students will be able to Describe the design concepts of counters and shift registers.Demonstrate the various techniques to develop |

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| | | | | A/D and D/A converters |
| 19PG4PE2A | Materials Science | National | Materials science occupies the centre of the innovative research area. This course deals with the various crystal growth techniques, characterization methods, thin films, nano materials and other types of materials such as polymers and ceramics and glass. | CO1. Students will be able to Deduce the expressions of Nucleation phenomena and explain various Crystal growth techniques<br>CO2. Students will be able to Explain the mechanism of molecular movements in Ceramics, Polymers and Composites<br>CO3. Students will be able to Analyse various methods of preparing thin films and its measurement techniches<br>CO4. Students will be able to Explore novel methods of preparing carbon nanomaterials |

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| | | | | and carbon nanotubes.<br>CO5. Students will be able to nderstand the concepts of Diffraction analysis, Thermal analysis and Electron microscopy used in crystal characterisation |
| 19PG4PE2B | Astro Physics | National | This course intends to give an insight into versatile concepts of astronomy namely origin and evolution of universe, observation techniques, stellar evolution, fate of stars and various mechanisms of stellar energy generation. | CO 1. Students will be able tooutline variety of objects in the Universe with a sense of scale for size and time and different types of observing techniques, instruments used in Astronomy.<br>CO2. Students will be able to acquire knowledge about the stellar evolution and mechanism of stellar energy generation |

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| | | | | CO3. Students will be able to gain an idea of fate of massive stars exploding as dazzling supernovae and medium mass stars condensing as neutron stars<br>CO4. Students will be able to explain the surface features and regions of the nearest star Sun and the impacts of the solar activities on earth.<br>CO 5. Students will be able to obtain knowledge about the origin and evolution of the Universe and comprehend its future course. |
| 19PAD2CA | Computer Applications LATEX | National | This course is designed to help the | CO 1. Students will be able to Install and understand the |

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| | | | students to type set articles, books, slide presentations. | basics of Latex<br>CO2. Students will be able to Defines commands for symbols, alignment and page layout in Latex<br>CO3. Students will be able to Create tables, figures using Latex<br>CO 4. Students will be able to Write documents containing mathematical formulas using Latex<br>CO5. Students will be able to Prepare presentation, articles, books using Latex. |
| 19PGSLP1 | Instrumentation and Experimental Methods | National | This course enables the students to understand, analyze | CO1. Students will be able to Explain the field of nanoscience to analyze and fit the |

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| | | | and implement the fundamental instrumentation and experimental methods of Physics. | experimental data with different kind of errors<br>CO2. Students will be able to explain principle, theory and application of various sensors and transducers<br>CO3. Students will be able to describe the various methods of vacuum and thin film measurements<br>CO4. Students will be able to Discuss the basic principle and importance of the different AC and DC measurement techniques.<br>CO5. Students will be able to Explain the developing instruments and their uses |

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| 21PG2PSL1 | Nanotechnology for All | National | This course provides knowledge about fabrication techniques and Grasping the Essence of Nanotechnology, carbon bands, Bucky balls, nanocomposites, nanofibers and medical applications of nanotechnology. | CO 1. Students will be able to brief about fabrication techniques and resources of nanotechnology.<br>CO 2. Students will be able to Build a Better world with Nanomaterials<br>CO3. Students will be able to describe The carbon nanotube connections<br>CO4. Students will be able to understand the Nano fibers<br>CO5. Students will be able to understand Nanotechnology in medical applications. |