FATIMA COLLEGE

(Autonomous)
Affiliated to Madurai Kamaraj University
Re-Accredited with 'A++' by NAAC (Cycle - IV)
Mary Land, Madurai - 625018, Tamil Nadu

AQAR – QUALITATIVE METRIC

2023 - 2024

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 Code: PAPH**

Programme Outcomes

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

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
23PG1P1	Mathematical Physics	National	This course emphasize the basic concepts and applications of Mathematical Physics which involves vectors, matrices,	CO1. Students will be able to Define and deduce gauss divergence and stokes theorem and solving problems on gauss divergence and stokes theorem.

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			complex variables, integral transforms and special functions	CO2. Students will be able to Discuss complex variables and Cauchy Residue Theorem. CO3. Students will be able to Explain special type of matrices and its Eigen value problems CO4. Students will be able to Illustrate the properties of Fourier and Laplace transforms CO5. Students will be able to Define Special Functions and find its relations
23PG1P2	Classical Mechanics And Relativity	Global	This course imparts a thorough knowledge of Mechanics of single particle and a system of particles, applying various classical theories. This would	CO1. Students will be able to understand the mechanics of single particle and system of particles and identify different types of constraints imposed on systems. CO2. Students will be able to derive Lagrange's equation

			help them to analyse any system using classical mechanics.	equation of motion for any given system according to Lagrangian formulation.
				CO3. Students will be able to explain the Hamilton's canonical equation of motion and hence to discuss motion of particle in a central force field.
				CO4. Students will be able to apply the theory of small oscillations to a linear triatomic molecule and get the normal modes and normal frequencies of the same.
				CO5. Students will be able to Understand and apply the principles of relativistic kinematics to the mechanical systems.
23PG1P3	Practical I	National	The course provides hands on training to work with fiber, Laser	Students will be able to handle the laboratory equipment's and develop lab skills in electronics

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			and young's modulus, AC bridges, Flip – Flop, and OP-AMP circuits.	experiments.
23PG1PE1	Linear And Digital Ics And Applications	Global	This course aims to introduce applied electronics to students, encompassing the concepts of Op-Amp characteristics and it's applications, registers, counters, and analog to digital conversion techniques.	CO1. Students will be able to Learn about the basic concepts for the circuit configuration for the design of linear integrated circuits and develops skill to solve problems CO2. Students will be able to Develop skills to design linear and non-linear applications circuits using Op-Amp and design the active filters circuits. CO3. Students will be able to Gain knowledge about PLL, and develop the skills to design the simple circuits using IC 555 timer and can solve problems related to it.

				CO4. Students will be able to Learn about various techniques to develop A/D and D/A converters. CO5. Students will be able to Acquire the knowledge about the CMOS logic, combinational and sequential circuits.
23PG1PE2	Medical Physics	National	This course aims to introduce to students, application of physics in the field of medicine, encompassing the principle and working of medical devices such as X-ray, Sphygmomanometer, Ultrasonic imaging as well as concepts on Radiation Protection.	CO1. Students will be able to Learn the fundamentals, production and applications of X-rays. CO2. Students will be able to Understand the basics of blood pressure measurements. Learn about sphygmomanometer, EGC, ENG and basic principles of MRI. CO3. Students will be able to Apply knowledge on Radiation Physics

				CO4. Students will be able to Analyze Radiological imaging and filters
				CO5. Students will be able to Assess the principles of radiation protection
23PG1PE3	Advanced Optics	National	This course introduces ray properties and wave nature of light. And also introduces about magneto and electro optics.	CO1. Students will be able to Understand the concept of polarization of light, production methods and double refraction.
				CO2. Students will be able to Understand the working of different types of LASERS
				CO3. Students will be able to Explain the types of fiber optics and their potential applications potential well; To discuss the problem of barrier penetration.
				CO4. Students will be able to Differentiate first and second harmonic generation and

				explain their applications
				CO5. Students will be able to Describe the principles of magneto-optic and electro-optic effects and its applications.
23PG1PE4	Communication Electronics	Global	This course introduces the working principle of fiber optics and its use in telecommunication.	CO1. Students will be able to Discuss and compare the propagation of electromagnetic waves through sky and on earth's surface Evaluate the energy and power radiated by the different types of antenna
				CO2. Students will be able to Compare and differentiate the methods of generation of microwaves analyze the propagation of microwaves through wave guides- discuss and compare the different methods of generation of microwaves
				CO3. Students will be able to

				Classify and compare the working of different radar systems- apply the principle of radar in detecting locating, tracking, and recognizing objects of various kinds at considerable distances – discuss the importance of radar in military- elaborate and compare the working of different picture tube
				CO4. Students will be able to Classify, discuss and compare the different types of optical fiber and also to justify the need of it- discover the use of optical fiber as wave guide
				CO5. Students will be able to Explain the importance of satellite communication in our daily life-distinguish between orbital and geostationary satellites elaborate the linking of satellites with ground station on

				the earth.
23PG1PAE	Digital Photography	National	This course will familiarize the students with the fundamental ideas of lens and camera.	CO1. Students will be able to Understand the basic concepts of photography CO2. Students will be able to Discuss the different types of lenses and to introduce the technical knowledge of SLR camera. CO3. Students will be able to Understand the focusing aspects of camera. CO4. Students will be able to understand the composition techniques of photography CO5. Students will be able to understand the types of photography and practising indoor and outdoor objects
23PG2P4	Statistical Mechanics	National	This course develops concepts in Classical	CO1. Students will be able to examine and elaborate the effect

				statistical mechanics, Quantum statistics and fluctuations .	of changes in thermodynamic quantities on the states of matter during phase transition
					CO2. Students will be able to analyze the macroscopic properties such as pressure, volume, temperature, specific heat, elastic moduli etc. using microscopic properties like intermolecular forces, chemical bonding, atomicity etc.
					CO3. Students will be able to Differentiate between canonical and grand canonical ensembles and to interpret the relation between thermodynamical quantities and partition function
					CO4. Students will be able to recall and apply the different statistical concepts to analyze the behaviour of ideal Fermi gas and ideal Bose gas and also to

				compare and distinguish between the three types of statistics. CO5. Students will be able to discuss and examine the thermodynamical behaviour of gases under fluctuation and also using Ising model.
23PG2P5	Quantum Mechanics-I	National	This course introduces Schrodinger equation, general formalism of quantum mechanics, exactly soluble Eigen value problems, representations and angular momentum.	CO1. Students will be able to Demonstrates a clear understanding of the basic postulates of quantum mechanics which serve to formalize the rules of quantum mechanics. CO2. Students will be able to apply and analyze the Schrodinger equation to solve one dimensional problems and three dimensional problems CO3. Students will be able to Can discuss the various

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				representations, space time symmetries and formulations of time evolution
				CO4. Students will be able to formulate and analyze the approximation methods for various quantum mechanical problems
				CO5. Students will be able to apply non-commutative algebra for topics such as angular and spin angular momentum and hence explain spectral line splitting.
23PG2P6	Practical II	National	The course provides hands on training to work with fiber, Laser and young's modulus, AC bridges, Flip Flop, and OP-AMP circuits.	Students will be able to handle the laboratory equipment's and develop lab skills in electronics experiments.
23PG2PE5	Advanced Mathematical	National	This course emphasise the basic	CO1. Students will be able to Define and Deduce illustrations

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	Physics		concepts and applications of Mathematical Physics which involves Tensors, Special functions and group theory.	in Physics as Tensors CO2. Students will be able to Discuss Legendre functions and recurrence formula CO3. Students will be able to Explain Bessel and Hermite functions CO4. Students will be able to Describe group, cyclic group , sub group and multiplication tables . CO5. Students will be able to Prove great orthogonality theorem and construct character tables of a group
23PG2PE6	Nonlinear Dynamics	National	This course introduces Basics of Numerical methods and Differential equations, Fundamentals of linear and nonlinear	CO1. Students will be able to analyze the numerical techniques of nonlinear dynamics CO2. Students will be able to Understand various dynamical

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			waves, and Basics of communication systems	systems CO3. Students will be able to explain the bifurcations and onset of chaos CO4. Students will be able to understand the concepts of various coherent structures CO5. Students will be able to describe the applications of solitons, chaos and fractals.
23PG2PE7	8086 Microprocessor And Microcontroller 8051	National	This course aims at providing the students with an exposure to the popular microprocessor Intel 8086 and the microcontroller Intel 8051	CO1. Students will be able to Gain knowledge of architecture and working of 8086 microprocessor CO2. Students will be able to write simple assembly language programs for 8086 microprocessor CO3. Students will be able to Learn about various techniques Of Interfacing A/D Converter

				Through Intel 8255.
				CO4. Students will be able to Gain knowledge of Intel 386 And 486 µP, And Pentium Processors.
				CO5. Students will be able to write simple assembly language programs for 8051 Microcontroller.
23PG2PE8	Biophysics	National	This course introduces fundamental concepts of Physics and Biology.	CO1. Students will be able to Understand the structural organization and function of living cells and should able to apply the cell signaling mechanism and its electrical activities.
				CO2. Students will be able to Comprehension of the role of biomolecular conformation to function.
				CO3. Students will be able to Conceptual understanding of the

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				function of biological membranes and also to understand the functioning of nervous system.
				CO4. Students will be able to know the effects of various radiations on living systems and how to prevent ill effects of radiations.
				CO5. Students will be able to Analyze and interpret data from various techniques viz., spectroscopy, crystallography, chromatography etc.
23PG2PAE	Modern Photography	Global	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	CO1. Students will be able to Understand the basic phenomena of photography
				CO2. Students will be able to discuss the optics behind photography
				CO3. Students will be able to Comprehend the types of

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			camera and Adobe Photoshop post processing.	camera, its important control parameters and composition techniques of photography CO4. Students will be able to understand the types of photography and practising indoor and outdoor objects CO5. Students will be able to Understand the modern technique of photoshop and develop skills to manipulate, edit and enhance the real time photographs using photoshop.
19PG3P13	Condensed Matter Physics	Global	The objective of this course is to understand the structure and properties of solid state materials .	CO1. Students will be able to Explain Fourier analysis of crystals and compute the structure factor - Discuss the various types of crystal binding CO2. Students will be able to Discuss quantization of elastic waves in lattice vibrations CO3. Students will be able to

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				Analyze the thermal properties of solids by applying different models CO4. Students will be able to Discuss the Kronig-Penney model and its implications CO5. Students will be able to Explain Fermi surfaces and determine the same by De Haas van Alphen effect
19PG3P14	Statistical Mechanics	National	This course develops concepts in Classical statistical mechanics, Quantum statistics, fluctuations and one dimensional random walk.	CO1. Students will be able to Analyse classical equilibrium thermodynamics to make physical predictions, describe the effects of quantum mechanics on statistical mechanics CO2. Students will be able to Acquire knowledge on Canonical and Grand canonical ensembles.

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				CO3. Students will be able to Understand the concepts of Bose Einstein condensation. CO4. Students will be able to Apply statistical mechanics to condensed matter systems such as Fermi gases, white dwarfs and nuclear matter. 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
19PG3P15	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.

				CO2. Students will be able to Describe nuclear energy sources CO3. Students will be able to Explain various nuclear models CO4. Students will be able to Describe nuclear reactions and solve some problems related to cross section CO5. Students will be able to Classify the elementary particles and explain their various properties
19PG3P16	Practicals V (General Physics Lab)	National	The lab course deals with Advanced General Experiments in Physics	Students will experience conceptual understanding of electrical, magnetic, optical and magneto-optic properties of materials, propagation of Ultrasonic waves through liquids, lattice parameters of crystals, principle and efficiency of solar water heater, properties of polarized light

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19PG3P17	Practicals VI (Advanced Electronics Lab)	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.
19PG4P18	Advanced Condensed Matter Physics	National	The objective of this course is to understand in depth the physics of the properties of metals, superconductors, dielectrics and magnetic solids	CO1. Students will be able to Analyse the dispersion of electromagnetic waves in a non-magnetic solid CO2. Students will be able to 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

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				CO3. Students will be able to Identify dielectric medium and analyze their polarization properties. CO 4. Students will be able to Apply quantum theory and analyze the magnetisation and susceptibility properties CO5. Students will be able to Discuss the formation of plasmons, polaritons, polarons and excitons and their interactions with the solids.
19PG4P19	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	CO1. Students will be able to identify the various interactions of radiation with matter and the corresponding regions in the electromagnetic spectrum. CO 2. Students will be able to derive the relationship between molecular spectra and molecular properties

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			structure, nature of bonding, molecular symmetry and inter and intra molecular interactions. This would help them to analyse any substance from the informations obtained through various spectroscopic techniques.	CO 3. To explain Microwave , Spin Resonance, Infra Red, Raman , Electronic and NMR spectra and the associated techniques and instrumentation. CO4. Students will be able to apply the theory to understand molecular spectra CO5. Students will be able to a derive Bloch equations.
19PG4P20	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 CO 2. Students will be able to Solve one dimension Schrödinger equation using WKB approximation method CO3. Students will be able to

				Explain about dipole approximation, harmonic perturbation, Fermi's Golden rule CO4. Students will be able to Understand partial wave analysis techniques CO5. Students will be able to Solve the problems using relativistic equations
19PG4P21	Practicals VII Advanced General Physics 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
19PG4P22	Practicals VIII Programming IN C++	National	The course deals with Computational Programming skills.	Students will be familiar the to apply numerical methods in modern scientific computing.
19PG3PE1A	Communication Systems	National	This course introduces the types	CO1. Students will be able to Explain amplitude modulation

			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.	techniques and sideband principles
				CO2. Students will be able to Describe the concepts of angle modulation and compare frequency and phase modulation
				CO3. Students will be able to Describe the key modules of digital communication systems with emphasis on...PAM, Pulse code modulation (PCM), DM
				CO4. Students will be able to Deduce the fundamental laws of of satellite communication and explain the principle of optical fiber communication
				CO5. Students will be able to Describe about basic, high frequency, microwave , wideband and special purpose antennas and principles of

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				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 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 1. Students will be able to Solve Algebraic and Transcendental equations numerically using Regula Falsi and Newton Raphson method CO 2. Students will be able to Apply newton's forward and backward interpolation formulae to equal and unequal intervals CO3. Students will be able to Evaluate numerical differentiation and integration CO4. Students will be able to Compose C++ program using structures and classes and apply inheritance and polymorphism features in C++ programming. CO5.Students will be able to Describe the design concepts of counters and shift registers.

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				Demonstrate the various techniques to develop 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 CO2. Students will be able to Explain the mechanism of molecular movements in Ceramics, Polymers and Composites CO3. Students will be able to Analyse various methods of preparing thin films and its measurement techniques CO4. Students will be able to Explore novel methods of preparing carbon nanomaterials and carbon nanotubes. CO5. Students will be able to

				Understand 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 to outline 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. CO2. Students will be able to acquire knowledge about the stellar evolution and mechanism of stellar energy generation 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 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. 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 students to type set articles, books, slide presentations.	CO 1. Students will be able to Install and understand the basics of Latex CO2. Students will be able to Defines commands for symbols, alignment and page layout in Latex CO3. Students will be able to Create tables, figures using Latex CO 4. Students will be able to Write documents containing mathematical formulas using

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				Latex
				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 and implement the fundamental instrumentation and experimental methods of Physics.	CO1. Students will be able to Explain the field of nanoscience to analyze and fit the experimental data with different kind of errors
				CO2. Students will be able to explain principle, theory and application of various sensors and transducers
				CO3. Students will be able to describe the various methods of vacuum and thin film measurements
				CO4. Students will be able to Discuss the basic principle and importance of the different AC and DC measurement

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				techniques.
				CO5. Students will be able to Explain the developing instruments and their uses
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. CO 2. Students will be able to Build a Better world with Nanomaterials CO3. Students will be able to describe The carbon nano tube connections CO4. Students will be able to understand the Nano fibers. CO5. Students will be able to understand Nanotechnology in medical applications.