FATIMA COLLEGE (AUTONOMOUS), MADURAI – 625018

2020 - 2021

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:

Students will be able to

PO 1: Gain exposure on the analysis and interpretation of mathematical models including the problems of physics

PO 2: Promote experimental skills

PO 3: Develop entrepreneurship and employability skills

PROGRAMME SPECIFIC OUTCOMES:

Students will

PSO 1: 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.

PSO 2: Understand and solve the physics problems in everyday life using the acquired basic knowledge.

PSO 3: Develop skills to perform experiments based on the theoretical understanding

PSO 4: Apply the knowledge acquired to analyse and design models in the versatile realm of physics

PSO 5: Equip with the essential foundations for higher education and research in physics.

COURSE CODE	COURSE TITLE	NATURE OF THE COURSE (LOCAL/NATIONAL/ REGIONAL/ GLOBAL)	COURSE DESCRIPTION	COURSE OUTCOMES
19PG1P1	Introduction To Mathematical Physics	National	This course emphasises the basic concepts and	Students will be able to CO1: Define and deduce gauss divergence and stokes

			applications of Mathematical Physics which involves vectors, matrices, integral transforms and special functions	theorem and solving problems on gauss divergence and stokes theorem CO 2: Discuss orthogonal curvilinear coordinates and spherical polar coordinates and solving problems using these coordinates CO 3: Explain special type of matrices and its Eigen value problems CO 4: Illustrate the properties of Fourier and Laplace transforms CO 5: Define Beta and 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.	CO 1: Students will be able to distinguish between BJT and FET CO 2: 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 CO 3: Students will be able to Outline the basics of linear and non linear systems CO 4: Students will be able to

				describe the design concept of counters and shift registers CO 5: 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.	Students will be able CO 1: To identify different types of constraints imposed on systems CO 2: To derive Lagrange's equation from Hamilton's variational principle and to write the equation of motion for any given

				system according to Lagrangian formulation. CO 3: To explain the two body central force problem and classification of orbits and hence to discuss scattering in a central force field. CO 4: To apply the theory of small oscillations to a linear triatomic molecule and get the normal modes and normal frequencies of the same. CO 5: To derive Hamilton's equations using Legendre transformation.

19PG1P4	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.	CO 1: Students will be able to handle the laboratory equipment's and develop lab skills in non-electronics experiments
19PG1P5	Practicals-II (Non-Electronics)	National	The course provides hands on training to work with counters, multivibrators and OP-AMP circuits, flip flops and microprocessor.	CO 1: Students will be able to handle the laboratory equipment's and develop lab skills in electronics experiments
19P1EDC/ 19P2EDC	Modern Photography	National	This course will familiarize the students with the fundamental	CO 1: On completion of this course, students will have the opportunity to personally experience the

			techniques necessary for the creative use of photography by introducing them to the basic usage of SLR camera and Adobe Photoshop post processing.	creative potential of photography and the languages linked to it.
19PG2P6	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	Students will be able to CO 1: Perform algebra with complex numbers and to Identify and determine the differentiable functions and find its derivatives CO 2: Identify the singularities of a function and determine whether they are removable

				poles are essential CO 3: Perform algebra of tensors and apply four vectors in special relativity and the formulation of electrodynamics CO 4: Discuss greens function for Sturn – Liouville operator and to compute dirac delta functions Green's functions and solving problems CO 5: Represent delta function and apply delta calculus
19PG2P7	Quantum Mechanics	National	This course introduces Schrodinger equation,	CO 1: To analyze the inadequacy of classical mechanics to

			general formalism of quantum mechanics, exactly soluble Eigen value problems , representations and angular momentum.	explain black body radiation, photoelectric effect, specific heat of solids and Compton effect. CO 2: To discuss the basic postulates of Quantum mechanics. CO 3: 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.

				CO 4: To solve the problem of Simple harmonic oscillator by Schrodinger's method and also by abstract operator method. CO 5: a) To compare Schrodinger's notation with Dirac notation and to discuss the representation of state vectors and operators. b) To outline the matrix representation of orbital and spin angular moment and to calculate Clebsch - Gordon coefficients.

19PG2P8	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 course provides a basic knowledge of fundamental principles behind Electromagnetic Theories and Phenomena.	CO 1: Gain insight about the electric field and their charge distribution at various condition such as in static and moving fields CO 2: Cultivate knowledge in dealing with the static electric field in dielectric media and their elaborated parameter study. CO 3: Develop thorough knowledge of static and moving magnetic fields of steady current and charged particles. CO 4: Detailed understanding of

				time dependent electric and magnetic fields and their wave propagation properties. CO 5: Acquire essential knowledge in circuitry in transmission lines and wave guides and a detailed study about antenna.
19PG2P9	Practicals (Non-Electronics)	National	The course provides hands on training to work with Four Probe method, Prism, Grating and Quinke's method.	CO 1: This course offers opportunity to handle the laboratory equipment's and develop lab skills innon-electronics experiments
19PG2P10	Practicals(Electronics)	National	The course provides hands on training to work with counters,	CO 1: This course offers opportunity to handle the laboratory equipment's and

			multivibrators and OP-AMP circuits, flip flops and microprocessor	develop lab skills in electronics experiments
19PG3P11	Condensed Matter Physics	Global	The objective of this course is to understand the structure and properties of solid state materials .	CO 1: Students will be able to Explain Fourier analysis of crystals and compute the structure factor - Discuss the various types of crystal binding CO 2: Discuss quantization of elastic waves in lattice vibrations CO 3: Analyze the thermal properties of solids by applying different models CO 4: Discuss the Kronig-Penney

				model and its implications CO 5: Explain Fermi surfaces and determine the same by De Haas van Alphen effect
19PG3P12	Statistical Mechanics	National	The course provides a conceptually based exposure to some advanced topics in the field of equilibrium statistical physics. The course links thermodynamics to the micro description used in classical Statistical Mechanics. The course enables the students to understand the	Students will be able to CO 1: Analyse classical equilibrium thermodynamics to make physical predictions, describe the effects of quantum mechanics on statistical mechanics CO 2: Acquire knowledge on Canonical and Grand canonical ensembles.

			concepts of M-B, B-E and F-D statistics and to apply them to the real systems.	CO 3. Understand the concepts of Bose Einstein condensation. CO 4: Apply statistical mechanics to condensed matter systems such as Fermi gases, white dwarfs and nuclear matter. CO 5: 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	This course provides	Students will be able to

			the knowledge about alpha and beta particles in nuclear physics. And it explains about nuclear fission and fusion reactions and its application in nuclear reactor. Expels knowledge in nuclear force and elementary particles.	CO 1: Define nuclear fission and fusion process and beta decay CO 2: Describe nuclear energy sources CO 3: Explain various nuclear models CO 4: Describe nuclear reactions and solve some problems related to cross section CO 5: Classify the elementary particles and explain their various properties
19PG3PE1A	Communication Systems	National	This course introduces the types of analog and	Students will be able to

			digital modulation-AM, FM and PM , its various spectra, bandwidth requirements, Generation & detection and power relations. Further it also gives the basics of satellite communication laws and a description of source and detectors of fiber optic communication. Also principles of basic, high frequency, microwave , wideband and special purpose	CO 1: Explain amplitude modulation techniques and sideband principles CO 2: Describe the concepts of angle modulation and compare frequency and phase modulation CO 3: Describe the key modules of digital communication systems with emphasis on. PAM, Pulse code modulation (PCM), DM CO 4. Deduce the fundamental laws of satellite communication and explain the principle of optical

			antennas and microwave generation are dealt here.	fiber communication CO 5. 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 algebraic & transcendental equations and also numerical differentiation and	Students will be able to CO 1: Solve Algebraic and Transcendental equations numerically using Regula Falsi and Newton Raphson method CO 2: Apply newton's forward and backward interpolation formulae to equal and

			integration. Also it provides object oriented techniques to write programs in C++ especially for all the numerical methods	unequal intervals CO 3: Evaluate numerical differentiation and integration CO 4: Compose C++ program using structures and classes and apply inheritance and polymorphism features in C++ programming. CO 5: Describe the design concepts of counters and shift registers. Demonstrate the various techniques to develop A/D and D/A converters

19PG3P17	Practicals V	National	The lab course deals with Advanced General Experiments in Physics	CO 1: 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
19PG3P15	Practicals VI	National	This course gives an opportunity to understand the characteristics and applications of	CO 1: Students will be able to use the various electronic devises mentioned here for various applications. Also the student is exposed to

			Electronic devises like Op- Amp, Photo diode, FET, UJT, SCR, Klystron, Micro controller and Transmission line.	Mathematica –Wolfram language and Wolfram cloud to plot simple functions.
19PGSLP1	Instrumentation and Experimental Methods	Global	This course enables the students to understand, analyze and implement the fundamental instrumentation and experimental methods of Physics.	CO 1: Explain the field of nanoscience to analyze and fit the experimental data with different kind of errors CO 2: Explain principle, theory and application of various sensors and transducers CO 3: Describe the various methods of vacuum and thin film measurements

				CO 4: Discuss the basic principle and importance of the different AC and DC measurement techniques. CO 5: Explain the developing instruments and their uses
19PG4P16	Advanced Condensed Matter Physics	National	The course enables the student : • To understand the transmission and reflection properties of plasmons • To study the types of lattice defects • To gain knowledge about the	Students will be able to CO 1: Analyse the dispersion of electromagnetic waves in a non-magnetic solid CO 2: Identify lattice vacancies and defects and explain the color centers in crystals Compare the behaviour of normal

			superconducting property of solids • To understand the polarisation and magnetisation properties of solids	conductor and superconductor Explain superconductivity based on various models and theories CO 3: Identify dielectric medium and analyse their polarization properties CO 4: Identify magnetic solids and their properties CO 5: Apply quantum theory and analyze the magnetisation and susceptibility properties CO 6: Discuss the formation of plasmons, polaritons,

				polarons 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 analyse any	Students will be able CO 1: To identify the various interactions of radiation with matter and the corresponding regions in the electromagnetic spectrum. CO 2: To derive the relationship between molecular spectra and molecular properties CO 3: To explain Microwave , Spin Resonance, Infra Red, Raman , Electronic and

			substance from the information's obtained through various spectroscopic techniques.	NMR spectra and the associated techniques and instrumentation. CO 4: To apply the theory to understand molecular spectra CO 5: To analyze the results of measurements using molecular spectroscopic methods and to solve problems related to spectroscopic studies of molecules
19PG4P18	Advanced Quantum Mechanics	National	This course deals with the approximation methods for stationary states, evolution of	Students will be able to CO 1: Understand perturbation theory Solve quantum

			time concepts, scattering theory and relativistic quantum mechanics.	mechanical problems using variation method CO 2: Solve one dimension Schrödinger equation using WKB approximation method CO 3: Explain about dipole approximation, harmonic perturbation, Fermi's Golden rule CO 4: Understand partial wave analysis techniques CO 5: Solve the problems using relativistic equations
PG4PE2A/ B	Materials Science/AstroPhysics	National	Materials science	Students will be able to

			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.	CO 1: Deduce the expressions of Nucleation phenomena and explain various Crystal growth techniques CO 2: Explain the mechanism of molecular movements in Ceramics, Polymers and Composites CO 3: Analyse various methods of preparing thin films and its measurement techniques CO 4: Explore novel methods of preparing carbon nanomaterials and carbon nanotubes.

				CO 5: Understand the concepts of Diffraction analysis, Thermal analysis and Electron microscopy used in crystal characterisation