DEPARTMENT OF PHYSICS

MAHARAJA'S COLLEGE, ERNAKULAM

PSO (PROGRAM SPECIFIC OUTCOMES)- M.Sc. PHYSICS

PSO1: Understand the conceptual basis of matrices, vectors and complex numbers, the advanced mathematical tools like groups and tensors and integral transforms, integral equations and special functions required to learn theoretical physics.

PSO2: Understand the concepts and facts of the electric, magnetic and thermodynamic properties of matter including its nanoscale- behaviour, the principles of photonics, analogue electronics, semi-conductor device physics, digital electronics, electronic communication and DSP and material science and the theoretical basis of classical and quantum mechanics, relativity, electrodynamics, astrophysics, nuclear and particle physics, gravitation and cosmology, non-linear dynamics, statistical mechanics and quantum field theory and apply the knowledge for analysing and solving problems.

PSO3: Understand and apply the concepts of electronics and micro- electronics in the designing of analogue and digital circuits.

PSO4: Understand the fundamentals of Programming and numerical techniques to apply it to solve theoretical problems.

PSO5: Understand, apply and verify the theoretical/empirical concepts and the experimental facts by practical.

Semester 1
Core Courses

PG1PHYC01: Mathematical Methods in Physics- I Credits - 4 Hours - 72

CO1. Understand the concepts and applications of matrices, complex functions, vectors and tensors in the analysis and theoretical conclusions of the problems in physics. PSO1, CL-U, Ap, An, KC-C

CO2. Understand and appreciate vector spaces as a general theory of the objects like matrices, tensors and complex functions. PSO1, CL-U, KC-C

CO3. Understand the special functions and integrals required to solve the theoretical problems of physics. PSO1, CL-U, Ap, KC-C

PG1PHYC02: Classical Mechanics I Credits - 4 Hours – 72

	Course Outcome	PSO	CL	KC	Sessions Allotted(hrs)
CO 1	Understand Lagrangian formulation of CM: Concepts like constraints, D'Alembert's principle and Lagrange's equations, calculus of variations, conservation theorems and symmetry properties, energy function and the	PSO2	U,An,Ap	C, P	22

	conservation of energy. Understand Legendre transformation and the Hamilton equations of motion, cyclic co-ordinates Hamilton's equations from a variational principle. Understand the theory of small oscillations with examples.				
CO 2	To understand the canonical transformation and H-J theory: Poisson brackets – fundamental Poisson brackets, Angular momentum Poisson brackets. Hamilton Jacobi equation for Hamilton's principal function, Harmonic oscillator problem, Hamilton Jacobi equation for Hamilton's characteristic function, action angle variables in systems of one degree of freedom, H-J equation as the short wave length limit of Schrodinger equation.	PSO2	U,An	C, P	14
CO 3	Understand C-F motion: equations of motion and first integrals, Kepler problem - inverse square law of force. Scattering in a central force field – Rutherford scattering formula, transformation of the scattering problem to laboratory co-ordinates.	PSO2	U,An	C, P	18
CO 4	Understand Rigid body dynamics: Independent co-ordinates of a rigid body, orthogonal transformations, angular momentum, kinetic energy, inertia tensor, principal axes, Euler's angles, infinitesimal rotations, Coriolis force, Euler's equations of motion, torque free motion of a rigid body.	PSO2	U,An,Ap	C, P	18

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PG1PHYC03: Electrodynamics I Credits - 4 Hours – 72

	COURSE OUTCOME	PSO	CL	KC	ALLOTTED SESSIONS
CO 1	Understand and apply the fundamentals of vector calculus	PSO1, PSO2	U, Ap	C, P	8
CO 2	Understand and analyze the electrostatic properties of physical systems	PSO2	U, An	C, P	8
CO 3	Understand basics of electrodynamics and physical properties of electromagnetic waves and apply it to the propagation of electromagnetic waves through vacuum, dielectric and matter	PSO2	U,Ap	C, F	20
CO 4	Understand the covariant formulation of electrodynamics and apply it to physical systems	PSO2	U, Ap	C, P	12
CO 5	Understand and analyze the propagation of electomagnetic waves in waveguide	PSO2	U, An	C, F	10
CO 6	Understand the theoretical concept of radiation from a moving charge and physical basis of radiation reaction	PSO2	U	C	14

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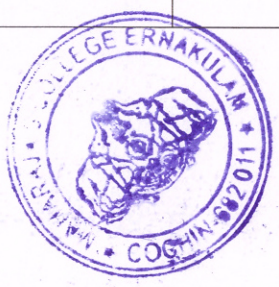
PG1PHYC04: Electronics I Credits - 4 Hours - 72

PG1PHYC04 -Electronics					
	COURSE OUTCOME	PSO	CL	KC	CLASS/SESSIONS ALOTTED
CO1.	Understand the working of op-amp, its various parameters, differentiate the gain of op-amp with feedback and without feedback ,compare the characteristics of ideal op-amp and practical op-amp.	PS03	U	F	18
CO2	Identify the factors responsible for variations in open-loop gain as a function of frequency, analyze the frequency response of internally compensated op-amps and non compensated op-amps , realize the difference between transient response and slew rate, apply their knowledge in general linear applications.	PS03	U, Ap	F	18
CO3	Understand the working of active filters,phase shift and wien bridge oscillators, square, triangular and sawtooth wave generators, voltage controlled oscillator,comparators,Schmitt trigger and their applications,design etc.	PSO3	U,An,Ap,C	F,P	18
CO4	Understand the microarchitecture of 8086,addressing modes,instruction set,assembler directives ,basic ideas of 8087 coprocessor.Learn to write basic programmes	PSO3	U,An	C,P	18



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PG1PHYP01: General Physics Practical I Credits - 3 Hours - 162

CO1. Understand how to apply and verify the theoretical concepts and facts through laboratory experiments. PSO5, CL-U, Ap, KC-C, F, P

Semester 2
Core Courses

PG2PHYC05:MathematicalMethodsinPhysics-II I Credits - 4 Hours - 72

CO1. Understand the concepts of special functions in physics. PSO1, CL-U, KC-C

CO2. Understand and appreciate integral transforms and its applications. PSO1, CL-U, Ap, KC-C

CO3. Understand and appreciate partial differential equations and integral equations and their applications in the problems of physics. PSO1, CL-U, Ap, KC-C, P
CO4: Understand the concept of groups and its properties. PSO1, CL-U, KC-C

PG2PHYC06: Quantum Mechanics I I Credits - 4 Hours – 72

	Course Outcome	PSO	CL	KC	Sessions Allotted(hrs)
CO 1	To understand the fundamental concepts of quantum mechanics through postulates and experiments. Unde rstanding of concepts like quantum mechanical state of a system, linear vector spaces, the Hilbert space, ket and bra, eigen values and eigen kets of an operator, the fundamental postulates, translation in space, momentum as generator of translation, fundamental commutation relations. Also concepts like admissibility conditions on wave function, probability interpretation, conservation of probability, box normalization.	PSO2	U, An	C, P	36
CO 2	Understand and apply the theory of angular momentum –rotation operator for spin 1/2 system, Pauli two component	PSO2	U, An	C, P	14

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	formalism, rotations in the two component formalism, eigen values and eigen states of angular momentum, matrix elements of angular momentum operators, orbital angular momentum, spherical harmonics, addition of two angular momenta – Clebsch - Gordan coefficients,				
CO 3	Understand various approximation methods in QM to solve non-exactly solvable problems, like Perturbation theory for stationary states –Variational method – WKB approximation and apply to physical problems	PSO2	U,An,Ap	C, P	22

PG2PHYC07: Statistical Mechanics I Credits - 4 Hours – 72

	Course Outcome	**PSO**	**CL**	**KC**
CO1	Understand the statistical basis of thermodynamics	PSO2	U	C
CO2	Understand and apply microcanonical, canonical and grand canonical ensemble theory to different physical systems.	PSO2	U, Ap	C, P
CO3	Understand apply ensemble theory to simple gases with and without internal motion.	PSO2	U, Ap	C
CO4	Understand and apply quantum mechanical ensemble theory using density matrix to various systems .	PSO2	U, Ap	C, P
CO5	Understand the behavior of Bose gas and apply Bose Einstein Statistics to black body radiation and heat capacity of solids.	PSO2	U, Ap	C,P
CO6	Understand the behavior of Fermi gas and apply Fermi Dirac Statistics to electron gas in metals and white dwarfs.	PSO2	U, Ap	C,P
CO7	Understand the phenomenon of phase transition and Ising model of phase transition	PSO2	U	C
CO8	Understand Non equilibrium statistical mechanics and apply it in Brownian motion.	PSO2	U	C

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PG2PHYC08: Solid State Physics I Credits - 4 Hours – 72

PG2PHYC08 – Solid state Physics					
	COURSE OUTCOME	PSO	CL	KC	CLASS/SESSIONS ALOTTED
CO1.	Recall the fundaments of crystal lattices , understand the classification of crystal systems and construction of reciprocal lattices ,identify the classical and quatum free electron theory and the related applications .	PSO2	U, Ap, An	C,P	18
CO2	Identify and differentiate the band theory of metals and semiconductors, apply the same in explaining the different physical properties of metals and semiconductors.	PSO2	U, An, Ap	C,F	20
CO3	Understand the heat transmissions in crystals based on theoretical foundations of phonons and lattice vibrations, differentiate the theories of the same.	PSO2	U, An,Ap	C	16
CO4	Applly the basic knowledge of quantum theory in magnetism and super conductivity.	PSO2	U, An,Ap	C	18

PG2PHYP02: Electronics Practical I Credits - 3 Hours - 162

CO1. Understand how to apply and verify the theoretical concepts and facts through laboratory experiments. PSO5, CL-U, Ap, KC-C, F, P
CO2. Understand and apply the concepts of electronics and micro-electronics in the designing of circuits. PSO3, CL-U, Ap, C, KC-C, F, P

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Semester 3
Core Courses

PG3PHYC09:Quantum Mechanics II I Credits - 4 Hours – 72

	Course Outcome	**PSO**	**CL**	**KC**
CO1	Understand time dependent perturbation theory and apply it to calculate transition probability in systems with constant, harmonic or other types of perturbations.	PSO2	U,Ap	C,P
CO2	Understand electric dipole approximation, sudden approximation and adiabatic approximation and apply them to physical systems.	PSO2	U, Ap	C
CO3	Understand scattering phenomena and apply it to calculate scattering cross section in high energy and low energy scattering problems using Born approximation and partial wave analysis respectively.	PSO2	U,Ap	C,P
CO4	Understand relativistic quantum mechanics using Klein Gordon equation and Dirac equation and their plane wave solutions.	PSO2	U	C
CO5	Understand the basics of quantum field theory, Quantization of Klein Gordon field and Dirac Field.	PSO2	U	C

PG3PHYC10: Computational Physics 4 Hours - 72

	COURSE OUTCOME	PSO	CL	KC	CLASS/SESSIONS ALOTTED
CO1.	Understand the curve fitting procedures and interpolation techniques. Applying this techniques in solving practical problems in physic	PS04	U,AP,C	C,P	15
CO2	Methodology for numerically	PS04	U,Ap,An,C	C,P	21

	integrating and differentiating differential equations is understood, analyzing and applying the same to solve differential equations.				
CO3	Formulating the first order differential equations with their initialization conditions in physics, identifying and comparing the different numerical techniques for the accurate determination of the solution.	PS04	C,Ap,An	C,P	18
CO4	Identify and recognize the different methods for solving linear system of equations ,analyzing and formulating the linear equations in different physical problems , applying the knowledge to find the solution.	PS04	U, Ap, An,C		18

PG3PHYP03: Computational Physics Practical I Credits - 3 Hours - 162

CO1. Understand how to apply and verify the theoretical concepts and facts through laboratory experiments. PSO5, CL-U, Ap, KC-C, F, P
CO2. Understand the fundamentals of Programming and numerical techniques to apply it to solve theoretical problems. PSO4, CL-U, Ap, C, KC-C, P

Semester 4
Core Courses

PG4PHYC11: Atomic and Molecular Spectroscopy Credits - 4 Hours – 72

		PO	CL	KC
CO 1	Understand origin of different atomic and molecular spectroscopic techniques	2	U	C,F
CO 2	Applying the spectroscopic tool to study the properties of elements and materials	2	U,AP, AN	C,F
CO 3	Undertand the theory and nature of raman spectroscopy and its applications	2	U,AP, AN	C,F
CO 4	understanding theoris of NMR,ESR and Mossbaur spectroscopy and application	2	U,AP, AN	C,F
CO 5	Calculating bond energy and bond lenth of moleculus by solving problems	2	U,AP, AN,C	C,F,P

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PG4PHYC12: Nuclear and Particle Physics Credits - 4 Hours – 72

	COURSE OUTCOME	PSO	CL	KC	CLASS/SESSIONS ALOTTED
CO1.	Understand the nuclear properties and different nuclear models and nuclear structure. Applying this concepts inunderstanding the nuclear scattering ,nuclear interactions.	PS02	U,AP,An	C, P	20
CO2	Differentiate the different nuclear decay processes and the theory related to it and identify and apply the same for solving nuclear decay and disintegration processes.	PS02	U,Ap,An	C, P	18
CO3	Understanding the different nuclear reactions and the theory behind it. Identifying the application of the same in different nuclear reactors.	PS02	U,Ap,An	C, P	18
CO4	Factual information related to the elementary particles, identify and distinguish the different quarks models.	PS02	U, An,C	F,P	16

Electives Courses - Group A - Theoretical Physics

Semester 3

PG3PHYEA01- Astrophysics I Credits - 4 Hours – 72

CO1. Understand the physics and mechanism of the gravitational collapse of massive clouds of particles and formation of stars. PSO2, CL-U, KC-C, F
CO2. Understand the nature of electrons and photons in the interior of stars and the kinds of possible pressures in stars. PSO2, CL-U, KC-C, F
CO3. Understand the physics of fusion of hydrogen, helium and the heavy elements in the core of stars. PSO2, CL-U, KC-C, F

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CO4. Understand the processes of heat-transfer across the stellar layers. PSO2, CL-U, KC-C, F
CO5. Understand the evolutionary tracks of stars leading to the three stellar dead materials. PSO2, CL-U, KC-C, F
CO6. Understand stellar atmosphere and learn how star could be modelled. PSO2, CL-U, Ap, KC- F, P

PG3PHEA02- Nonlinear Dynamics I Credits - 4 Hours – 72

		PO	CL	KC
CO1	Understand the basic ideas of non linear system , chaos and fractals	1	U, AP	C, F
CO2	catogorising 1D, 2D and 3D phase space dynamics and asses them to solve the problems	1,2	U,AP, AN, C	C, F
CO3	correlate the different routes to chaos for a dynamical system	2	U,AP, AN	C, F
CO4	examine the different mapping procedures and measure the degree of chaos	2	U,AP, AN, C	C, F

Semester 4

PG4PHYEA03- Gravitation & Cosmology I Credits - 4 Hours - 72

CO1. Understand the concept of tensors and tensor algebra; apply the knowledge in the analysis of the properties of its mathematical space. PSO1, CL-U, Ap, An, KC-C, P

CO2. Understand General Relativity theory and its consequences. PSO2, CL-U, KC-C

CO3. Learn to apply General Relativity to the problem of the gravitational field of a sphere of mass. PSO2, CL-U, Ap, KC-P

CO4. Learn how to apply Gravitational field equation to a space of FRW metric. PSO2, CL-U, Ap, KC-P
CO5. Understand the current cosmological facts about the Universe. PSO2, CL-U, KC-F

PG4PHYEA04- Quantum Field Theory I Credits - 4 Hours – 72

C01	Understand and execute the concept of quantization of classical and quantum fields to get field propagators	PS05	CL - U, Ap	KC – F, C
C02	Analyse the Feynmann rules to compute S-matrix elements in perturbation theory	PS05	CL - An, Ap	KC – C, P

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C03	Examine the functional quantization techniques and symmetry properties for scalar, vector and spinor fields	PS05	CL – An, Ap	KC – C
C04	Apply the gauge theories with spontaneous symmetry breaking, to verify the theory of weak interactions	PS05	CL – U, Ap, An	KC – C, P

PG4PHYEAP01- Special Computational Lab I Credits - 3 Hours - 162

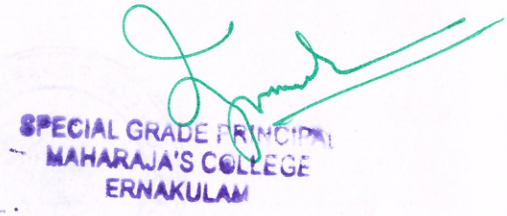
CO1. Understand how to apply and verify the theoretical concepts and facts through laboratory experiments. PSO5, CL-U, Ap, KC-C, F, P
CO2. Understand the fundamentals of Programming and numerical techniques to apply it to solve theoretical problems. PSO4, CL-U, Ap, C, KC-C, P

Electives Courses - Group B - Applied Physics

Semester 3

PG3PHYEB01-Semiconductor device Physics and Micro electronics I Credits - 4 Hours - 72

PG3PHYEB01 – Semiconductor Device Physics and Microelectronics				
COURSE OUTCOME	PSO	CL	KC	CLASS/SESSIONS ALOTTED
Understand and distinguish the theory behind the constructional features of semiconductor devices like Schottky diode, JFET, MESFET, HEMT, MOSFET and IGBT	PSO3	U, Ap	C, P	25
To analyze qualitatively and quantitatively the operational principles of semiconductor devices.	PSO3	U, An	F,P	25
To Understand the internal architecture and programming of 8051 microcontroller and thus to analyze and solve various problems in Physics	PSO4	U, An, Ap	C, P	22



PG3PHYEB02- Material Science Credits - 4 Hours – 72

PG3PHYEB 02- MATERIALS SCIENCE					
	COURSE OUTCOME	PSO	CL	KC	CLASS/SESSIONS ALOTTED
CO1.	Understand and distinguish between various types of crystal imperfections and to get knowledge about phase diagrams and laws of diffusion	PSO2	U,An, Ap	C, F	18
CO2	To get knowledge about formation of thin films and properties of nanostructured materials.	PSO2	U, An	C, F	18
CO3	To understand , differentiate and analyze various methods for the preparation and characterization of thin films and nanomaterials	PSO2	U, An, Ap	C, P	18
CO4	Understand the various applications of thin films and nanostructured materials	PSO2	U, An, Ap, C	C, P	18

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Semester 4

PG4PHYEB03- Photonics Credits - 4 72

PG4PHYEB 03 - Photonics					
	COURSE OUTCOME	PSO	CL	KC	CLASS/SESSIONS ALOTTED
CO1 .	Understand and distinguish different optical waveguides and propagation modes, realize the parameters associated with them, perceive the transmission characteristics of optic fibre , infer the various fibre losses ,Applying the knowledge in communication technology.	PSO2	U, Ap, An	C, P	18
CO2	Identify and differentiate the theory behind different types of Laser systems.	PSO2	U,An	F	18
CO3	Theory behind the nonlinear optical phenomenon and interactions are classified and recognized, different types of phase matching methods are understood	PSO2	U, An,Ap	C	18
CO4	Understand the quantum confinement effects , distinguish various quantum confined materials, grasp the idea of metallic	PSO2	U, An,Ap	C	18

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	nanostructures and their applications.				

PG4PHYEB04- Electronic Communication & DSP Credits - 4 Hours – 72

PG4PHYEB 04 - Electronic Communication and Digital Signal Processing					
	COURSE OUTCOME	PSO	CL	KC	CLASS/SESSIONS ALOTTED
CO1.	To learn the fundamental theory behind transmission lines and comprehend its applications	PSO2	U, An, Ap	C,F,P	18
CO2	To learn the fundamentals of DSP and its mathematical foundations	PSO2	U, An	F,P	20
CO3	To comprehend the fundamental ideas of DSP in designing IIR and FIR filters	PSO2	U, An, Ap	C,P	20
CO4	To understand the foundations of analog and digital electronic communication systems	PSO2,PSO3	U	F,P	14

PG4PHYEBP01- Applied Physics Lab Credits - 3 162

CO1. Understand how to apply and verify the theoretical concepts and facts through laboratory experiments. PSO5, CL-U, Ap, KC-C, F, P

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CO2. Understand and apply the concepts of electronics and micro-electronics in the designing of circuits. PSO3, CL-U, Ap, C, KC-C, F, P

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