MAHENDRA ARTS & SCIENCE COLLEGE

(AUTONOMOUS)

(Affiliated to Periyar University)

[Accredited by NAAC "A" Grade & Recognized u/s 2(f) and 12(B) of the UGC act 1956]

KALIPPATTI-637501.

MASTER OF SCIENCE

SYLLABUS FOR M.Sc.PHYSICS

OUTCOME BASED EDUCATION - CHOICE BASED CREDIT SYSTEM

FOR THE STUDENTS ADMITTED FROM
THE ACADEMIC YEAR 2019 – 2020 ONWARDS

MAHENDRA ARTS & SCIENCE COLLEGE
(Autonomous)
(Affiliated to Periyar University)
Department of PHYSICS

M.Sc. PHYSICS

PREAMBLE

The PG & Research Department of Physics offers programs in conventional Physics to a broad range of students through creative and learning and teaching methodology which enables them to integrate this knowledge into their normal thought processes. Also, The department provides a forward-looking curriculum to undergraduate Physics majors, involving not only conventional Physics topics but also state-of-the-art instruction through Theory and Practical experimental techniques. On the other hand, computational and theoretical Physics with computers for data acquisition and analysis, as well as active involvement in professional research.

I - PROGRAMME EDUCATIONAL OBJECTIVES:

- Technical Proficiency: Obtaining successful employment to their respective interests, education and to become socially responsible physicist
- Professional growth: Developing life long learning, higher education and research in their respective areas of specialization
- Management growth: Improving leadership quality through innovative manner

II - PROGRAMME OUTCOMES:

- **Knowledge:** has substantial knowledge in physics and basic knowledge in mathematics along with advanced knowledge in some areas in physics
- **Skill:** can combine and use knowledge from several disciplines and independently assess and evaluate research methods and results
- **General competence:** has the ability to successfully carry out advanced tasks and projects, both independently and in collaboration with others, and also across disciplines

III - REGULATIONS

These regulations shall take effect from the academic year 2019-2020, i.e, for students who are to be admitted to the first year of the course during the academic year 2019-20 and thereafter.

These regulations shall take effect from the academic year 2019-2020, i.e, for students who are to be admitted to the first year of the course during the academic year 2019-20 and thereafter.

1. Objectives of the Course:

- To create socially responsible citizens with sound scientific background
- To involve the students to familiar with various platforms of the Physics
- To allow the students to enrich their knowledge toward research and development

2. Eligibility for Admission:

A Candidate who has passed the B.Sc degree examination with Physics as the main subject or B. Sc applied Physics or B. Sc Physics (Vocational) of this university or an examination of some other universities accepted by the syndicate as equivalent thereto.

3. Duration of the Course:

The candidates shall complete all the courses of the programme in 2 years from the date of admission. The programme of study shall consist of four semesters and a total period of two years with a minimum of 90 credits. The programme of study will comprise the course according to the syllabus.

4. Course of Study:

The course of study for the PG degree courses of all branches shall consist of the following:

(i) Core courses
(ii) Electives courses
(iii) Skill Enhancement Courses
(iv) Extra Disciplinary Course
(v) Project
(vi) Enhancement Compulsory Courses.

5. Examinations

The course of study shall be based on semester pattern with Internal Assessment under Choice Based Credit System.

The examinations for all the papers consist of both Internal (Continuous Internal Assessment - CIA) and External (End Semester) theory examinations. The theory examinations shall be conducted for three hours duration at the end of each semester. The candidates failing in any subjects(s) will be permitted to appear for the same in the subsequent semester examinations

6. Structure of the Programme:

SEMESTER: I

Course Category	Title of the Course	Course Code	Hrs / Week		No. of Credits	Max. Mark		
			L	P		Int.	Ext.	Total
CORE –I	CLASSICAL MECHANICS		5	-	4	25	75	100
CORE –II	MATHEMATICAL PHYSICS – I		6	-	4	25	75	100
CORE –III	ELECTRONICS		5	-	4	25	75	100
CORE –IV	OPTICS AND LASER PHYSICS		5	-	4	25	75	100
ELECTIVE – I	ELECTIVE –I		5	-	4	25	75	100
CORE PRACTICAL-I	PRACTICAL–I GENERAL PHYSICS EXPERIMENTS - I		-	4	3	40	60	100
Total			**26**	**4**	**23**	**165**	**435**	**600**

SEMESTER: II

Course Category	Title of the Course	Course Code	Hrs / Week		No. of Credits	Max. Mark		
			L	P		Int.	Ext.	Total
CORE –V	MATHMATICAL PHYSICS –II*		5	-	4	25	75	100
CORE –VI	QUANTUM MECHANICS- I		5	-	4	25	75	100
CORE -VII	MICROPROCESSOR AND MICRO CONTROLLER		5	-	4	25	75	100
ELECTIVE –II	ELECTIVE –II		5	-	4	25	75	100
CORE PRACTICAL –II	PRACTICAL- II ELECTRONICS EXPERIMENTS		-	4	3	40	60	100
EDC	-		4	-	4	25	75	100
ECC	HUMAN RIGHTS		2	-	2	25	75	100
	COMPREHENSIVE EXAM - I				1	-	-	100
Total			**26**	**4**	**26**	**190**	**510**	**800**

* Open Book Examination Pattern (OBE)

SEMESTER: III

Course Category	Title of the Course	Course Code	Hrs / Week		No. of Credits	Max. Mark		
			L	P		Int.	Ext.	Total
CORE –VIII	QUANTUM MECHANICS – II		6	-	4	25	75	100
CORE –IX	STATISTICAL MECHANICS		5	-	4	25	75	100
CORE –X	COMPUTATIONAL METHODS AND PROGRAMMING		5	-	4	25	75	100
CORE –XI	ELECTRO MAGNECTIC THEORY		5	-	4	25	75	100
ELECTIVE – III	ELECTIVE –III		5	-	4	25	75	100
CORE PRACTICAL-III	PRACTICAL - III GENERAL PHYSICS EXPERIMENTS – II		-	4	3	40	60	100
Total			**26**	**4**	**23**	**165**	**435**	**600**

SEMESTER: IV

Course Category	Title of the Course	Course Code	Hrs / Week		No. of Credits	Max. Mark		
			L	P		Int.	Ext.	Total
CORE -XII	CONDENSED MATTER PHYSICS		5	-	4	25	75	100
CORE -XIII	NUCLEAR AND PARTICLE PHYSICS		5	-	4	25	75	100
CORE -XIV	SPECTROSCOPY*		5	-	4	25	75	100
ELECTIVE -IV	ELECTIVE –IV		5	-	4	25	75	100
CORE PRACTICAL -IV	PRACTICAL - IV MICROPROCESSOR AND MICROCONTROLLOR EXPERIMENTS		-	4	3	40	60	100
	PROJECT		-	4	3	40	60	100
	COMPREHENSIVE EXAM - II				1	-	-	100
Total			**22**	**8**	**23**	**180**	**420**	**700**

* Open Book Examination Pattern (OBE)

Summary of Credits, Hours and Marks Distribution

Course Category	Credits				Total Credits	Total Hours	No. of Courses	Max. Marks
	I	II	III	IV				
Core	16	12	16	12	56	70	14	**1400**
Elective	4	4	4	4	16	20	4	**400**
SEC	-	-	-	-	-	-	-	**-**
EDC	-	4	-	-	4	4	1	**100**
Practical	3	3	3	3	12	16	4	**400**
Project	-	-	-	3	3	4	1	**100**
Human Rights	-	2	-	-	2	2	1	**100**
Online course					2			**200**
TOTAL					**95**	**120**	**25**	**2700**

ELECTIVE SUBJECTS FOR M.Sc. Physics STUDENTS

Semester	ELECTIVE – I	
I	**Course Title**	**Course Code**
	X Ray Crystallography and Biophysics	
	Elements of NanoScience and Technology	
	Crystal And Characterization	
ELECTIVE – II		
II	**Course Title**	**Course Code**
	Thin film Physics	
	Ultrasonics and its applications	
	Non Linear Dynamics	
ELECTIVE – III		
III	**Course Title**	**Course Code**
	Nano Physics	
	Medical Physics	
	Opto Electronics	
	ELECTIVE – IV	
IV	**Course Title**	**Course Code**
	Characterization of materials	
	Energy physics	
	Communication Electronics	

IV SCHEME OF EXAMINATION:

1. Question Paper Pattern for Theory Papers

Time: Three Hours Maximum Marks: 75

Part A: (10 x 1 = 10)
Answer ALL Questions
(Objective Type - Two Questions from each unit)

Part B: (5 x 2 = 10)
Answer ALL Questions
(One Question from each unit)

Part C: (5 x 5 = 25)
Answer ALL Questions
(One Question from each unit with internal choice)

Part D: (3 x 10 = 30)
Answer Any Three out of Five Questions
(One Question from each unit)

2. Question Paper Pattern for Practical Papers

EXTERNAL MARK: 60
INTERNAL MARK : 40

3. Distribution of Marks:

The following are the distribution of marks for external and internal for End Semester Examinations and continuous internal assessment and passing minimum marks for Theory/Practical / Mini project / Project papers of PG programmes.

ESE	EA Total	Passing Minimum for EA	CIA Total	Passing Minimum for CIA	Total Marks Allotted	Passing Minimum (ESE)
Theory	75	38	25	12	100	50
Practical	60	30	40	20	100	50
Mini Project	--	--	100	50	100	50
Project	60	30	40	20	100	50

THEORY

EVALUATION OF INTERNAL ASSESSMENT

Test	: 10 Marks
Seminar	: 05 Marks
Assignment	: 05 Marks
Attendance	: 05 Marks
Total	: 25 Marks

The Passing minimum shall be 50% out of 25 marks (13 marks)

PRACTICAL

EVALUATION OF INTERNAL ASSESSMENT

Test 1	: 15 Marks
Test 2	: 15 Marks
Record	: 10 Marks
Total	: 40 Marks

The Passing minimum shall be 50% out of 40 marks (20 Marks)

PROJECT

EVALUATION OF INTERNAL ASSESSMENT

Review 1	: 10 Marks
Review 2	: 5 Marks
Review 3	: 5 Marks
Pre-Viva	: 5 Marks
Total	: 25 Marks

The Passing minimum shall be 50% out of 40 marks (20 marks)

4. Passing Minimum:

The Candidates shall be declared to have passed the examination if he/she secures not less than 50 marks in total (CIA mark + Theory Exam mark) with minimum of 38 marks in the End Semester Theory Examinations.

The Candidates shall be declared to have passed the examination if he/she secures not less than 50 marks in total (CIA mark + Practical Exam mark) with minimum of 30 marks in the End Semester Practical Examinations.

5. Submission of Record Note Books for Practical Examinations

Candidates appearing for practical examinations should submit a bonafide record note books prescribed for practical examinations. The candidates failed to submit the record book shall not be permitted to appear for the practical examinations

6. Project

The following guidelines to be followed for the Project with Viva-voce:

1. The project should be valued for 60 marks by an external examiner; however the Viva-Voce examination should be conducted by both the external examiner appointed by the College and the internal examiner / guide/ teacher concerned.

2. The Project Report may consist a minimum of 60 pages.

3. The candidate has to submit the Project Report 20 days before the commencement of the VI Semester Examinations.

4. A candidate who fails in the Project/Dissertation or is absent may resubmit the report, on the same topic, with necessary modification / correction / improvements in the subsequent Even Semester Examinations for evaluation and shall undergo viva-voce Examination.

7. Note

a) SWAYAM / MOOC – Free Online Education

SWAYAM / MOOC are an instrument for self-actualization providing opportunities for a life-long learning. Here the student can choose from hundreds of courses, virtually every course taught at the college level, offered by the best teachers in India and elsewhere.

The students can choose an online SWAYAM / MOOC course during their period of study which will earn an extra credit and it will be transferred to the academic records of the students.

b) Comprehensive Examination

This examination will be conducted at the end of each academic year. Mode of the examination will be online (Computer based test). The pattern of questions will be objective type and covers the entire syllabi.

c) Open Book Examination

The examinees are allowed to make use of their class notes, textbooks, and other approved materials (Except Electronic Gadgets) while answering questions.

SEMESTER I

CORE - 1	M.Sc- PHYSICS	2019 – 2020
M19PPH01	CLASSICAL MECHANICS	
CREDITS: 4		

Objectives

The present course titled "Classical Mechanics" completely deals about the Newtonian Mechanics in association with Lagrangian, Hamiltonian, etc., which will be helpful to understand the Physical laws.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Remember Newtonian laws	K1
CO2	Understand Lagrangian and Hamiltonian Principle	K2
CO3	Analyze Poisson's Brackets & Hamilton-Jacobi Theory	K3
CO4	Apply studied theories for various applications such as statics and dynamical systems	K4

Unit –I Lagrangian Formulation

Limitation of Newton's method –Centre of Mass- Mechanics of system of Particles- Constraints- Generalized co-ordinates- D'Alembert's principle and Lagrangian equation of motion for the monogenic system with holonomic constrains –and with non-holonomic constraints – variational principles and Lagrangian equation for holonomic and non-holonomic systems-Simple application-Double pendulum –Atwood's machine- Bead sliding on rotating wire in a force.

Unit –II Hamiltonian Formulation

Legendre transformations and the Hamilton's equations of motion - Cyclic co-ordinates and Conservation theorems- Deduction of Hamilton's Principle from the D' Alembert's Principle- Deduction of Hamilton's equations from the modified Hamilton's principle-Principle of least action-Canonical transformations.

Unit –III Poisson's Brackets & Hamilton-Jacobi Theory

Poisson's Bracket-Liouville's theorem-Hamilton-Jacobi Theory –Action and Angle variables –Kepler's –problem-Simple applications of Hamiltonian dynamics: compound pendulum –two dimensional harmonic oscillator.

Unit –IV Small Oscillations and Rigid-body Dynamics

General theory of small oscillation - Lagrange's equation of motion for small oscillation-solution of eigenvalue equation-normal co-ordinates and normal frequencies of vibration.

Euler's angle - Equation of motion of Rigid body -Euler's equations-the motion of a symmetric top under action of gravity.

Unit –V Special Relativity

Lorentz transformation-consequences of Lorentz transformation:- Length contraction: simultaneous, time dilation-Force in relativistic mechanics-Minkowski space and Lorentz transformation-orthogonal transformation-Thomas Precession- four vectors-covariant Lagrangian formulation for a freely moving particle.

TEXT BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Classical Mechanics	H.Goldstein	Narosa Publishing	2008
2	Classical Mechanics	V.B. Bhatia	Narosa Publishing	1997
3	Classical Mechanics	J.C. Updhaya	Himalaya Publishing House	2003

REFERENCE BOOKS:-

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Classical Mechanics	N.C.Rana and P.S. Joag,	Tata McGraw-Hill	1991
2	Classical Mechanics	Gupta & Kumar	Tata McGraw-Hill	1991

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	M	S	M
CO2	S	S	M
CO3	S	S	M
CO4	M	M	S

CORE - 2	M.Sc- PHYSICS	2019– 2020
M19PPH02	MATHEMATICAL PHYSICS-I	
CREDITS: 4		

Objectives

The present title gives the detailed ideas about matrices and their respective determinants, Laplace, Differential and Fourier series etc. And the extension of the unit will be presented in semester III.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Remember basic matrix and the calculation determinants	K1
CO2	Summarize the salvation of differential equations	K2
CO3	Analyze special differential equations	K3
CO4	Apply Fourier series and Laplace transforms to various Physical problems	K4

Unit-I Matrices and Determinants

Properties of matrix addition and multiplication – different type of matrices and their properties – Rank of a Matrix and some of its theorems – Solution to linear homogeneous and non homogeneous equations – Cramers rule – eigen values and eigenvectors of matrices – differentiation and integration of matrix.

Unit-II Solving of differential equations

Homogeneous linear equations of second order with constant coefficients and their solutions ordinary second order differential with variable coefficients and their solution by power series and Frobenius methods – extended power series method for indicial equations.

Unit-III Special differential equations and their solutions

Legendre's differential equation: Legendre polynomials – Generating functions – Recurrence Formulae–Rodrigue's formula–orthogonality of Legendre's polynomial; Bessel's differential equation: Bessel's polynomial – generating functions–Recurrence Formulae–orthogonal properties of Bessel's polynomials– Hermite differential equation– Hermite polynomials – generating functions – recurrence relation.

Unit-IV Laplace Transforms

Laplace transforms: Linearity property, first and second translation property of LT – Derivatives of Laplace transforms – Laplace transform of integrals – Initial and Final value theorems; Methods for finding LT:direct and series expansion method, Method of differential equation; Inverse Laplace transforms: Linearity property, first and second translation property, Convolution property – Application of LT to differential equations and boundary value problems.

Unit-V Fourier series and integrals

Fourier series definition and expansion of a function x – Drichlet's conditions - Assumptions for the validity of Fourier's series expansion and its theorems – Complex representation of Fourier series – problems related to periodic functions – graphical representation of FS – Fourier integrals – convergence of FS – some applications of Fourier transforms.

TEXT BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Mathematical Physics	B.D.Gupta	(Vikas Publishing House PVT.LTD) 3rd Edition	2006
2	Topics in Mathematical Physics	H Parthasarathy	H Ane Books Pvt. Ltd	2007
3	Mathematical methods for physics -	G. Arfken	Elsevier 6th edition	2010

REFERENCE BOOKS:-

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Advanced Engineering mathematics	Erwin Kreyszig	Wiley Easter Limited Publications 7th Edition	1993.
2	Mathematical Physics	Rajput	Pragati Prakasam 17th Edition	2004

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	S	S	S
CO2	S	M	M
CO3	M	S	S
CO4	M	M	S

CORE - 3	M.Sc- PHYSICS	2019– 2020
M19PPH03	ELECTRONICS	
CREDITS: 4		

Objectives

The present course explores the basic ideas about electronics and extends it towards the fabrication of integrated circuits. Also it covers special types of semi conducting materials. It deals about the basic concepts of converts and registers.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Remember basic concepts of ICs	K1
CO2	Summarize the principles of semi conducting devices	K2
CO3	Analyze the functions of registers and counters	K3
CO4	Apply Timers for various applications	K4

UNIT I : Integrated Circuits

Integrated Circuits –Types of Integrated Circuits – Analog and Digital Integrated Circuits –Basic monolithic ICs – epitaxial growth – masking – etching impurity diffusion – fabricating monolithic resistors, diodes, transistors, inductors and capacitors – circuit layout – contacts and inter connections –The continuity equation for a diode – Application of the continuity equation for an abrupt PN junction under forward and reverse bias – Einstein equation.

UNIT II : Special Semiconductor Devices

JFET – Structure and working – VI Characteristics under different conditions – biasing circuits – CS amplifier design – AC analysis – MOSFET – Depletion and Enhancement type MOSFFT – UJT characteristics – relaxation oscillator – SCR characteristics – application in power control – DIAC, TRIAC.

UNIT III : Operational Amplifier and Applications

Solving simultaneous and differential equations – Voltage to current and current to voltage conversions – active filters: low pass, .high pass, band pass and band rejection filters – Wien bridge, phase shift oscillators – Triangular, saw-tooth and square wave generators – Schmitt's trigger – sample and hold circuits – Voltage control oscillator.

UNIT IV : IC 555 Timer and Applications

IC 555 Timer – Internal architecture and working – Monostable Operation – Applications in monostable mode – Linear ramp generator – Frequency divider – Astable operation – Applications in astable mode – phase locked loops – Monolithic phase locked loops.

UNIT V : Counters and Converters

Basic D to A conversion: weighted resister DAC – Binary R-2R ladder DAC – Basic A to D conversion: counter type ADC – successive approximation converter – dual slope ADC – JK flip flop and T flipflop – Counters – 4 bit synchronous and asynchronous counters as up and down counters – BCD counter – Shift registers – serial and parallel shift registers.

BOOKS FOR STUDY AND REFERENCE

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Active and Nonlinear Electronics	T.F. Schubert and E.M.Kim,	John Wiley Sons	1996
2	Electronic Devices	L. Floyd	Pearson Education, New York	2004
3	Transitors	Dennis Le Crissitte,	Prentice Hall India Pvt. Ltd	1963
4	Integrated Electronics	J. Millman and C.C. Halkias,	McGraw Hill, New Delhi	1972

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	S	M	S
CO2	M	M	M
CO3	S	M	S
CO4	M	S	M

CORE - 4	M.Sc - PHYSICS	2019 – 2020
M19PPH04	OPTICS AND LASER PHYSICS	
CREDITS: 4		

Objectives

The present title will be helpful academically and industrially to make the students towards the development of optics and technology.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Remember optical laws such as reflection and refraction	K1
CO2	Discuss the production and applications of LASER	K2
CO3	Give the difference between linear and non linear optics	K3
CO4	Discuss the diffraction phenomenon and their applications	K4

Unit-I Lasers:

Review of Einstein's coefficients, Light amplification, Spatial and temporal coherence, Threshold condition, Rate equations for 2 and 3 level systems, Laser pumping requirements, Output coupling, Cavity modes, quality factor, Mode selection and mode locking, Q-switching. Some laser systems: He-Ne, Nd:YAG, Dye lasers, Semiconductor lasers.

Unit-II Propagation of light in optical media:

Dispersion: dispersion in dilute and dense gases, group and signal velocities. Anisotropic media: Fresnel's equation, uniaxial and biaxial crystals, double refraction, polarizing prisms. Jones vector and linear, circular, elliptic states of polarization, Malus' law, Jones matrices and linear optical devices, phase retarders, quarter and half wave plates, Stokes parameters.

Unit-III Wave optics: Interference: Planar wave description of light, two-beam interference, Michelson interferometer, Multi-beam interference, Fabry-Perot interferometer.

Unit-IV Diffraction: Kirchhoff's diffraction theory, regimes of diffraction, Fresnel and Fraunhofer diffraction, rectangular slit, circular aperture, single and multiple slit diffraction.

Unit-IV Non-linear Optics: Interaction of radiation with a dielectric medium, dielectric susceptibility, Harmonic generation, Second harmonic generation, Phase matching criterion, coherence length for second harmonic radiation, optical mixing, third harmonic generation, self focusing of light, parametric generation of light.

BOOKS FOR STUDY AND REFERENCE

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Optical Electronics	A. Ghatak and K. Thyagarajan,	Cambridge University Press	2004
2	Optics – Principles and Applications	K. K. Sharma	Academic Press, MA,	2006
3	Laser Fundamentals	Silfvast,	Cambridge Press,	1998
4	Principles of Optics	Born and Wolf.	Cambridge Press,	1998

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	M	S	S
CO2	S	M	M
CO3	M	S	M
CO4	M	M	M

Elective	M.Sc- PHYSICS	2019– 2020
M19PPHE01	X-RAY CRYSTALLOGRAPHY BIOPHYSICS	
CREDITS: 4		

Objectives

The present course titled "X-ray crystallography Bio Physics" completely deal about the concepts of X-ray crystals and diffraction methods in association with Phase problems and understand the Physical laws through data collection.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Remember Seven types of crystal systems	K1
CO2	Understand the techniques involved in Data Collection	K2
CO3	Analyze Phase Problem to solve the crystal structure	K3
CO4	Apply studied theories for various applications such as Bio Physics etc.,	K4

UNIT I : X-ray and crystals

Origin of X-rays – conventional generators-construction and geometry sealed tube- rotating anode generator-choice of radiation-Synchrotron radiation - Lattice planes-Miller indices - X-ray diffraction - Crystal systems and symmetry – unit cell –space lattices- non primitive lattices – point groups– space groups – analysis of space group symbols - Crystallization – growing crystals – choosing a crystals – crystal mounting- alignment – measurement of crystal properties.

Unit II: Data collection techniques for single crystals:

Laue method- single crystal diffraction cameras: rotation and Oscillation method – Ewald construction - Single crystal diffractometers: Instrument geometry-crystal in a diffracting position – Datacollection strategy: determination of unit cell – orientation matrix - Intensity Datacollection - Unique data –equivalent reflections –selection of data.

UNIT III : Data Reduction

Integration of intensity - Lorenz and Polarization corrections – absorption – deterioration or radiation damage – scaling – Interpretation of Intensity. Structure factors and Fourier syntheses: Structure factor –Friedel's Law – exponential and vector form – generalized structure factor – Fourier synthesis –Fast Fourier transform – Anomalous scattering and its effects. Calculation of structure factors and Fourier syntheses.

UNIT IV: Phase Problem

Methods of solving Phase Problem: Direct methods – Patterson methods – Heavy atom methods. Refinement of crystal structures: Weighting – Refinement by Fouriersyntheses – Locating Hydrogen atoms identification of atom types – least squares –goodness of fit –least square and matrices-correlation coefficients – Relationship between Fourier and Least squares – Practical consideration in least squares methods – Random and systematic errors– Molecular geometry – absolute configuration – thermal motion.

UNIT V : Cell organelles and molecules

Basic structure of prokaryotic and eukaryotic cells – mitochondiria and the generation of ATP – Chemical composition of living systems – molecular components of cell – chemical structure of carbohydrate–Lipids-proteins–Nucleic acids–hetro macro molecules.

Molecular interactions: Molecular forces – forces hold macro molecules together

–intermolecular weak forces – van der waals – inductive force – dispersion force –Lenard-Jones potential – hydrogen bond – hydrophobic forces – acid, bases and pH,pK, pl and buffering.

BOOKS FOR STUDY & REFERENCE:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	X-ray Structure Determination,	Second Edition, Stout and Jensen,	John Wiley Publications.	1989
2	Fundamentals of Crystallography	C. Giacovazzo,	Second Edition, Oxford Press.	1991
3	Structure Determination by X-ray Crystallography,	Ladd and Palmer.	Second Edition, Oxford Press.	1998
4	Molecular Biophysics, Structure in motion,	M. Duane,	Oxford University Press	1994

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	S	S	S
CO2	M	S	S
CO3	S	M	S
CO4	M	M	M

Elective	M.Sc- PHYSICS	2019– 2020
M19PPHE02	ELEMENTS OF NANO SCIENCE AND TECHNOLOGY	
CREDITS: 4		

Objectives

Bearing in mind the role of the applications of recent technologies The present course deals about the innovations of Nano science and Technology. Also it deals about the Physical and chemical properties of Materials in Nanoscale level.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Remember the differences between chemical and physical properties	K1
CO2	Understand the techniques involved in the synthesis of nanomaterials	K2
CO3	Analyze nanomaterials using various characterization techniques	K3
CO4	Apply studied theories for various applications which lying in Nanoscale level	K4

UNIT - I : Basics of Nanotechnology

Background to Nanotechnology - scientific revolutions - types of nanotechnology and nano machines - atomic structure molecules & phases - molecular and atomic size - surfaces and dimensional space - top down and bottom Nanoscale formation

UNIT - II : Nanocrystals

Synthesis of metal Nan particles and structures - Background on quantum semiconductors - Background on reverse Miceller Solution - Synthesis of semiconductors - Cadmium telluroid nano crystals - Cadmium sulfide nano crystals - Silver sulfide nano crystals - Nano manipulator - Nano tweezes - Nanodots.

UNIT - III : Nano Tubes

Types of nanotubes - formation of nanotubes - methods and reactants - arcing in the presence of cobalt - laser methods - ball milling - chemical vapour deposition methods -properties of nano tubes - plasma arcing - electro deposition - pyrolytic synthesis - Zeolites and templated powders layered silicates.

UNIT - IV : Characterization of Nanomaterials

Scanning Electron Microscope : Theory - Instrumental setup and its application - Low KV SEM and its application - Low temperature SEM and its application - working of electron probe micro analysis and its application in elemental analysis - EDX spectra Important material systems- optical process in semiconductors - optical process in quantum wells - semi conducting optoelectronic devices- organic ptoelectronic devices (qualitative).

UNIT - V : Applications of Nanotechnology

Structural and Mechanical materials - Nan electronics - opto electronic devices - LED – Applications - Colorants and Pigments - Nano - Lithography - Nanobiotechnology - DNA-Chips, DNA array devices, drug delivery systems.

BOOKS FOR STUDY & REFERENCE:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Introduction to Nanotechnology	Charles P. Poole, Frank J. Owens	Wiley	2003
2	Nanotechnology: Basic science and emerging technologies	Mick Wilson	Overseas Press	2005
3	Amorphous and Nanocrystalline Materials:	A.Inoue, K.Hashimoto	Prentice Hall of India	2000
4	Nanostructures and Nanomaterials (Synthesis, Properties and Applications	Guozhong Cao.	Prentice Hall, Inc.,	1998

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	S	S	M
CO2	M	M	S
CO3	S	M	M
CO4	M	M	M

Elective - I	M.Sc - PHYSICS	2019 – 2020
M19PPHE03	CRYSTAL AND CHARACTERIZATION	
CREDITS: 4		

Objectives

The present elective title gives the elaborate ideas about crystals and their classifications. Also it deals the Physics governing the crystals and their growth techniques in detail along with applications.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Remember fundamentals of crystal growth and their importance	K1
CO2	Understand the theories of crystal growth phenomenon	K2
CO3	Give the experimental ideas about crystal growth	K3
CO4	Discuss the various crystal growth techniques with advantages and disadvantages	K4

Unit – I:

Crystal systems and symmetry – unit cell –space lattices- non primitive lattices – point groups–space groups – analysis of space group symbols - Crystallization – growing crystals – choosing a crystals – crystal mounting- alignment – measurement of crystal properties. Fundamentals of Crystal Growth Importance of crystal growth – Classification of crystal growth methods – Basic steps: Generation, transport and adsorption of growth reactants – Nucleation: Kinds of nucleation –Classical theory of nucleation: Gibbs Thomson equations for vapour and solution – Kinetic theory of nucleation.

Unit – II: Theories of Crystal Growth An introductory note to Surface energy theory, Diffusion theory and Adsorption layer theory –Concepts of Volmer theory, Bravais theory, Kossel theory and Stranski's treatment – Two- dimensional nucleation theory: Free energy of formation, Possible shapes and Rate of nucleation – Mononuclear, Polynuclear and Birth and Spread models.

Unit – III: Experimental Crystal Growth-Part-I: Melt Growth Techniques. Basics of melt growth – Heat and mass transfer – Conservative growth processes: Bridgman-Stockbarger method – Czochralski pulling method – Kyropolous method – Nonconservative processes: Zone-refining – Vertical and horizontal float zone methods – Skull melting method – Vernueil flame fusion method.

Unit – IV: Experimental Crystal Growth-Part-II: Solution Growth Techniques. Growth from low temperature solutions: Selection of solvents and solubility – Meir's solubility diagram – Saturation and supersaturation – Metastable zone width – Growth by restricted evaporation of solvent, slow cooling of solution and temperature gradient methods– Crystal growth in Gel media: Chemical reaction and solubility reduction methods – Growth from high temperature solutions: Flux growth Principles of flux method .

Unit –V Experimental Crystal Growth-Part-III: Vapour Growth Techniques. Basic principles – Physical Vapour Doposition (PVD): Vapour phase crystallization in a closed system – Gas flow crystallization – Chemical Vapour Deposition (CVD): Advantageous and disadvantageous – Growth by chemical vapour transport reaction: Transporting agents, Sealed capsule method, Open flow systems.

BOOKS FOR STUDY AND REFERENCE

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Crystal Growth Processes'	J.C. Brice,	John Wiley and Sons, New York	1986
2	Crystallization'	J.W. Mullin	Elsevier Butterworth-Heinemann, London	2004
3	Crystal Growth: Principles and Progress'	A.W. Vere,	Plenum Press, New York.	1987
4	Crystal Growth	B.R. Pamplin	Pergamon Press, Oxford.	1975

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	M	M	M
CO2	S	M	S
CO3	S	S	S
CO4	M	S	M

Semester-II

CORE - V	M.Sc- PHYSICS	2019– 2020
M19PPH05	MATHEMATICAL PHYSICS-II	
CREDITS: 4		

Objectives

The present title gives the detailed ideas about Probability, Complex variables and group theory and their respective applications, Linear vector variables and tensor analyses. And the extension of the unit will be presented in previous semester I.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Remember basic Probability and the calculation in distributions	K1
CO2	Summarize the salvation of complex variables	K2
CO3	Analyze special features of group theory	K3
CO4	Apply Laplace and Tensor analyses for various Physics problems	K4

Unit –I Probability

Probability-Addition rule of Probability - Multiplication Law of Probability-Probability distribution-Binomial distribution - mean Binomial distribution - Standard deviation of binomial distribution -Poisson distribution - Normal distribution - characteristics of normal distribution - Applications of normal distribution.

Unit – II Complex variables

Complex Algebra- Cauchy-Riemann Conditions-Cauchy's Integral Theorem- Cauchy's Integral formula-Laurent expansion-singularities-Mapping- Conformal mapping- Calculus of residues.

Unit – III Group Theory

Definition of Group - Subgroup, invariant group, abelian group, orthogonal and unitary groups -Homomorphism, isomorphism - Reducible and irreducible representations - Generators of Continuous groups.

Unit – IV Linear vector spaces

Definition and Examples-Real Linear vector space-Uniqueness of Null and Reversed vectors- Scalar Products of Vectors- : Definition of Scalar Product of two vectors, Scalar product for real linear vector spaces, Cauchy-Schwartz inequality-Metric Spaces-Linear Independence of vectors and basis for a vector space-Dimension of a vector space-Orthonormal basis-Vector Subspaces-Direct sum decomposition.

Unit – V Tensor Analysis

Definition of Tensors – Contravariant, covariant and mixed tensors – addition and subtraction of Tensors – Summation convention- Symmetry and Anisymmmetry Tensor – Contraction and direct product – Quotient rule- Pseudotensors, Levi-Civita Symbol - Dual tensors, irreducible tensors-Metric Tensors-Christoffel symbols – Geodesics.

BOOKS FOR STUDY AND REFERENCE:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Mathematical Physics	B.D. Gupta	Vikas Publishing House Pvt.Ltd	2006
2	Mathematical Methods for Physicists	Arfken & Weber	Elsevier 6th edition	2010
3	Topics in Mathematical Physics	David J Griffiths -	Parthasarathy H Ane Pvt.Ltd.- New DeL hi	2007
4	Mathematical Physics	H.K. Dass and R. Verma	S. Chand & Company 2nd Ed	2001

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	M	S	M
CO2	M	S	M
CO3	M	S	M
CO4	M	M	S

CORE - VI	M.Sc- PHYSICS	2019– 2020
M19PPH06	QUANTUM MECHANICS- I	
CREDITS: 4		

Objectives

The failures of classical mechanics unleash the behaviors of matters at the microscopic level. The modern physics with the title quantum mechanics will open the puzzles of various physical properties at the microscopic level.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Distinguish classical and quantum mechanics	K1
CO2	Discuss the hypothesis of quantum mechanics	K2
CO3	Give the time dependent and independent ideas	K3
CO4	Discuss the applications of quantum mechanics	K4

UNIT - I: Basics of wave mechanics

Equation of motion of matter waves- Schroedinger equation for the free particle -Physical interpretation of wave function-normalized and orthogonal wave functions-expansion theorem-admissibility conditions - solution of Schroedinger wave equation - stationary state solutions operator associated with different observables - expectation values - probability current density- Ehrenferts theorem. System of identical Particles: symmetric and antisymmetric wave functions - Exclusion principle.

UNIT - II : Stationary state and eigen spectrum

Stationary states: time independent Schrodinger equation - Particle in a square well potential - Bound states -eigen values, eigen functions - nonlocalized states -potential barrier -quantum mechanical tunneling - reflection at barriers and wells-multiple potential well -Splitting energy levels-energy bands-Kronig - Penny model. Exactly soluble Eigenvalue Problems The simple harmonic oscillator: Energy Eigenvalues and energy eigen functions -properties of stationary states- abstract operator- eigen value spectrum-eigen functions- Angular momentum: operators- Separation of variables-eigen values and eigen functions- spherical harmonics.

UNIT - III : Approximation methods for Time - independent Problems

Perturbation theory for discrete levels: Equations in various orders of perturbation theory - Non-degenerate case-first and second order anharmonic oscillator-Degenerate case- removal of degeneracy - Effect of electric field (stark effect) on ground state of Hydrogen atom - two electron atom. Variation method: Variation Principle - for excited states-ground state of Helium atom -hydrogen atom ion - WKB approximation - one dimensional Schrodinger equation-Asymptotic solution-validity of WKB approximation-solution near a turning point – connection formula for penetration barrier - Bohr-Sommer field quantization condition- tunneling through a potential barrier.

UNIT - IV : Matrix formulation of quantum theory and equation of motion

Quantum state vectors and functions- Hilbert space-Dirac' s -Bra-Ket notation-basis in Hilbert space - dynamical variables and linear operators - abstract operators - self adjoint –eigen value, eigen vectors - unitrary operators - representations of state vector-dynamical variables as matrix operators - commutation relation – diagonalization Harmonic oscillator-Schrodinger, Heisenberg and Interaction representation - coordinates and momentum representations - symmetries and conservation laws.

UNIT -V : Angular momentum

Angular momentum operators-commutation rules-eigen value spectrum matrix representation of J in the |jm> basis - spin angular momentum - spin 1/2 , spin-1, total wave function- addition of angular momenta- Clebsch-Gordan coefficients-spin wave functions for a system of two spin-1/2 particles. Identical Particles and spin Identical Particles - symmetry and Antisymmetric wave function - exchange degeneracy - Spin and statistics: Pauli's exclusion Principle- Slater determinant- collision of identical particles-spin and Pauli's matrices- density operator and density matrix.

BOOKS FOR STUDY AND REFERENCE

S.No	Title of the Book	Author	Publisher	Year of Publication
1	A Text book of Quantum Mechanics	B.D.Gupta	P. M. Mathews and K.Venkatesan	2006
2	Quantum Mechanics	Satya Prakash	Kedar Nath Ram Nath and Co. Publications	2002
3	Principle of Quantum Mechanics (2nd Edition)	R.Shankar	PlenumUS Publication	2002

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	S	S	S
CO2	S	M	M
CO3	M	M	S
CO4	S	M	M

CORE - VII	M.Sc- PHYSICS	2019– 2020
M19PPH07	MICROPROCESSOR AND MICROCONTROLLER	
CREDITS: 4		

Objectives

The present title gives Architecture and Programming of 8085, 8086 and applications of Microprocessor and microcontroller respectively in detail.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Familiar with architecture and programming of 8085	K1
CO2	Brief about the architecture of 8086	K2
CO3	Analyze the applications of microprocessor and microcontrollers	K3
CO4	Apply Programming languages for various applications	K4

UNIT - I Architecture and Programming of 8085

Architecture of 8085 - Organization of 8085: Control, data and address buses - registers in 8085 - Addressing modes of 8085 - Instruction sets of 8085: Instruction types (based on number of bytes, based on operation), data transfer, arithmetic, logical, branching, stack and I/O instructions. Timing and sequencing : Instruction cycle, machine cycle, halt state, walt state-Timing diagram for opcode fetch, memory read and write cycles. Assembly language programming, Simple programs using arithmetic and logical operations - Interrupts: Maskable and non-maskable, hardware and multilevel interrupts.

UNIT - II Architecture of 8O86

Memory organization, Register organization: General purpose, index, pointer, segment registers and flags - Bus structure: data bus, address bus, effective & physical address and pipeling. Addressing modes of 8086: Register, immediate, direct and indirect addressing.

UNIT - III Applications of Microprocessors

Microprocessor based process control - closed loop control - open 1oop control. Example for closed loop control - crystal growth control. Microprocessor based temperature monitoring systems - limit setting - operator panel - block diagram. Analog to digital conversion using ADC 0809 interfacing through PPI 8255 - Block diagram.

UNIT - IV Architecture of Microcontroller 8051

Introduction - comparison between microcontroller and microprocessors - Architecture of 8051 - Key features of 8051 - memory organization - Data memory and program memory-internal RAM organization - Special function registers - control registers - I/O ports - counters and timers - interrupt structure.

UNIT - V Programming the Microcontroller 8051

Instruction set of 8051 - Arithmetic, Logical, Data move jump and call instructions, Addressing modes - Immediate, register, direct and indirect addressing modes - Assembly language programming - simple programs to illustrate arithmetic and logical operations (Sum of numbers, biggest and smallest in an array) - software time delay.

BOOKS FOR STUDY AND REFERENCE

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Introduction to Microprocessors	Aditya P.Mathur	Tata McGraw Hill Company, II edition.	2006
2	Microprocessor Architecture, Programming and Application with 8085	Ramesh S.Gaonkar	Wi1ey Eastern.	1998
3	Microprocessors and Interfaces	Douglas V.Hall	Tata McGraw Hill Company.	1983
4	Introduction to Microprocessors	Aditya P.Mathur	Tata McGraw Hill Company, III edition.	1971

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	M	S	S
CO2	S	S	M
CO3	S	M	S
CO4	M	M	S

Elective - II	M.Sc - PHYSICS	2019 – 2020
M19PPHE04	THIN FILM PHYSICS	
CREDITS: 4		

Objectives

The elective course will be basic platforms for researchers and students in thin film science and technology. It deals preparation and coating techniques and also gives the idea about the measurement of the thickness of thin films. Also it provides characterization of thin films.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Proceed the application of Physics in thin film science and technology	K1
CO2	Understand the difference between thin film with other existing technologies	K2
CO3	Analyze the measurement techniques involved in thin films	K3
CO4	Apply the techniques to know the Physical properties of thin films by suitable methods	K4

UNIT - I: Preparation of Thin Films Spray pyrolytic process – characteristic feature of the spray pyrolytic process – ion plating – Vacuum evaporation – Evaporation theory – The construction and use of vapour sources – sputtering Methods of sputtering – Reactive sputtering – RF sputtering - DC planar m magnetron sputtering .

UNIT - II: Thickness measurement and Nucleation and Growth in Thin Film) Thickness measurement : electrical methods – optical interference methods – multiple beam interferometry – Fizeau – FECO methods – Quartz crystal thickness monitor . Theories of thin film nucleation – Four stages of film growth incorporation of defects during growth .

UNIT - III: Electrical properties of metallic thin films Sources of resistivity in metallic conductors – sheet resistance - Temperature coefficient of resistance (TCR) – influence of thickness on resistivity – Hall effect and magneto resistance – Annealing – Agglometation and oxidation .

UNIT - IV: Transport properties of semiconducting and insulating Films Semiconducting films ; Theoretical considerations - Experimental results – Photoconduction – Field effect thin films – transistors, Insulation films Dielectric properties – dielectric losses – Ohmic contracts – Metal – Insulator and Metal – metal contacts – DC and AC conduction mechanism .

UNIT - V: Optical properties of thin films and thin films solar cells Thin films optics –Theory – Optical constants of thin films – Experimental techniques – Multilayer optical system – interference filers – Antireflection coating ,Thin films solar cells : Role, Progress , and production of thin solar cells – Photovoltaic parameter, Thin film silicon (Poly crystalline) solar cells : current status of bulk silicon solar cells – Fabrication technology – Photo voltaic performance : Emerging solar cells : GaAs and CulnSe .

BOOKS FOR STUDY AND REFERENCE

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Hand book of Thin films Technology	L I Maissel and R Clang .	Second Edition, Prentice Hall India	1989
2	Thin film Phenomena	K L Chopra .	Fourth Edition, John Wiley & Sons,	2005
3	physics of thin films,	George Hass and others .Saunders,	Prentice Hall India Pvt. Ltd	1983

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	S	S	M
CO2	M	M	S
CO3	M	M	M
CO4	S	M	M

Elective - II	M.Sc- PHYSICS	2019– 2020
M19PPHE05	ULTRASONICS AND ITS APPLICATIONS	
CREDITS: 4		

Objectives

In recent years Ultrasonic play a major role in the fields of scanner technologies and biological studies. With this connection the present title enhance the students towards the development of knowledge about Ultrasonic and their respective applications.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Recall the fundamentals of sound	K1
CO2	Understand the Propagation of ultrasonic through different medium	K2
CO3	Give the experimental ideas about Ultrasonic during generation	K3
CO4	Discuss the various applications of ultrasonic	K4

UNIT I : Source of Ultrasonic waves

Piezo electric - magnetostrictive transducers, electromechanical coupling factors and transducer efficiency - Transducers and band width characteristics – Equivalent electrical circuit of piezoelectric vibrators. Detection of ultrasonic waves: Mechanical, thermal, electrical and optical methods.

UNIT II : Techniques used in ultrasonic investigations

Interferometer, Optical, pulse, sing-around, radiation pressure and streaming
methods – Measurement of propagation constants in different media – Relative merits of the techniques – Diffraction effects of sound velocity and absorption measurements– Hypersonic velocity and absorption measurements.

UNIT III : Propagation of ultrasonic waves in liquids

Propagation of ultrasonic waves in liquids: mixtures. Excess compressibility and the relation to excess volume – Excess intermolecular free length – relative association. Sound velocity and compressibility of electrolytic solutions – Dispersion of sound in liquids – Different mechanisms of the absorption of sound – Relaxation phenomenon.

UNIT IV : Dielectric measurements

Continuous wave and pulse techniques for measuring elastic constants of solids - Determination of elastic constants of cubic crystals – Dielectric behavior of materials –Dipole moment of polar and non – polar molecules – dielectric relaxation time – permittivity of solutions – breakdown – Strength of Glasses – Dielectric properties of liquid mixtures at different temperatures – Dielectric absorption.

UNIT V : Applications

Acoustical grating – sonar – depth of sea – measurement of velocity of blood flow and movement of heart – Ultrasonic imaging – High resolution images – Non destructive testing – Principle – Methods – Liquid penetrant method - - Ultrasonic flaw detector – X- ray Radiography and Fluoroscopy – Thermography - Applications of Ultrasonics in NDT.

BOOKS FOR STUDY & REFERENCE:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Fundamentals of Ultrasonics, Second Edition,	J. Blitz,	Plenum Press, New York	1967
2	Physical Acoustics	W.P. Mason,	Second Edition, Oxford Press.	1959
3	Sonics	P.P. Hueter and R.H. Bolt,	Wiley, New York	1955
4	Molecular Acoustics	J. Matheson	Wiley, New York	1971

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	S	M	S
CO2	S	M	S
CO3	M	S	M
CO4	M	S	M

Elective - II	M.Sc- PHYSICS	2019 – 2020
M19PPHE06	NONLINEAR DYNAMICS	
CREDITS: 4		

Objectives

The development of dynamics plays a major role in the field of classical mechanics. By bearing in mind the applications of dynamics, the present course deals about dynamics in non linear conditions. After the completion of the course, the students are able to understand the concepts of non linear dynamics using theoretical knowledge.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Recall the classifications of motions	K1
CO2	Understand Newtonian laws of motion	K2
CO3	Give the theoritical ideas about Chaos	K3
CO4	Discuss the various applications of Non linear equations thorough suitable tools	K4

UNIT I : Introduction to Nonlinear Dynamical Systems

The notion of nonlinearity – superposition principle and its validity – linear and nonlinear oscillators – autonomous and non autonomous systems – equilibrium points – phase space classification of equilibrium points.

UNIT II : Chaos

Simple bifurcations – the logistic map – period doubling phenomenon – onset of chaos – bifurcation scenario in Duffing oscillator – chaos in conservative systems – Poincare surface of section – Henon – Heiles systems – Lyapunov exponents.

UNIT III : Solitons

Nonlinear dispersive system – cnoidal solitary waves – the scott Russles Phenomenon and K – dV equation – Fermi – Pasta – Ulam Numerical experiment – Numerical experiment of Zabusky and kruskal – birth of soliton.

UNIT IV : Tools to solve Non – linear Equations

Integrability and methods to solve equations the notion of Integrability – Painleve analysis – Lax pair – Inverse Scatting Transform method Bilinearization procedure – examples – Koteweg – de – Vires – Nonlinear Schordinger equations.

UNIT V : Application of Non – Linear Dynamics

Applications – Chaos and secure communications – soliton in condensed matter system – Non linear optics and biological systems.

BOOKS FOR STUDY AND REFERENCE

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Nonlinear systems,	P.G. Drazin,	Cambridge University Press, Cambridge	1992
2	Solitons, An introductions,	P.G. Drazin and R.S.Johnson,	Cambridge University Press, Cambridge	1989
3	solutions, Nonlinear Evolution Equations and Inverse Scattering,	M.J. Ablowitz and P.A Clarkson,	Cambridge University Press, Cambridge	1991

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	S	M	S
CO2	S	M	S
CO3	M	S	M
CO4	M	S	M

Semester-III

CORE - VIII	M.Sc - PHYSICS	2019 – 2020
M19PPH08	QUANTUM MECHANICS – II	
CREDITS: 4		

Objectives

The failures of classical mechanics unleash the behaviors of matters at the microscopic level. The modern physics with the title quantum mechanics will open the puzzles of various physical properties at the microscopic level.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Distinguish classical and quantum mechanics	K1
CO2	Discuss the hypothesis of quantum mechanics	K2
CO3	Give the ideas about identical particles	K3
CO4	Discuss the applications of quantum mechanics	K4

UNIT I : Systems of identical particles

Indistinguishability of identical particles – Symmetric and anti Symmetric wave function – Exchange operator – Distinguishability of identical particles – Bosons and Fermions – Pauli's Exclusion principles – Collision of identical particles – Ensemble of identical particle systems– Density operator – Density matrix – Properties – Symmetric and Anti symmetric wave function of hydrogen molecule.

UNIT II : Scattering Theory

Differential and Total cross-section – Scattering amplitude – Green's function: formal expression for scattering amplitude – Born approximation and its validity – scattering by coulomb and Screened coulomb potentials – Square-well potential – Exponential – Gaussian potential – Partial wave analysis – Phase Shifts – Scattering amplitude in terms of phase shift– Low energy scattering: Scattering length and effective range scattering by a perfectly rigid sphere.

UNIT III : Emission and absorption of radiation

Semi – Classical theory of radiation: Einstein coefficients – atom field interaction –Transition probabilities for stimulated emission and absorption and spontaneous emission of radiation – Electric dipole transition – Selection rules and polarizability – Quantum theory of radiation: Radiation field Hamiltonian – Radiation field as an assembly of oscillators – emission and absorption rates.

UNIT IV : Atomic and molecular Structure

Approximations in atomic structure – Central field approximation – Thomas Fermi Statistical model – Hartree - Fock Equation – The method of self consistent field – Residual electrostatic and spin orbit interaction – Alkali atoms – Doublet separation – Coupling schemes – Hydrogen molecule – Covalent bond.

UNIT V : Relativistic Wave equation

The Klein – Gordon Equation – Charge and current densities in four vector – KG equation in electromagnetic field – The Dirac relativistic equation: The Dirac matrices – Free particle solutions – Meaning of negative energy states– Electromagnetic potential: magnetic moment of the electron – Existence of electron spin - Spin orbit energy.

BOOKS FOR STUDY AND REFERENCE:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Quantum Mechanics	Satyaprakash	Kedar Nath Ram Nath.	2007
2	Quantum Mechanics	P.M. Mathews and K. Venkatesan	Tata McGraw Hill	2006
3	Quantum Chemistry	R.K. Prasad	New Age International Pvt. Ltd. 6.	2000
4	Quantum Mechanics	Gupta, Kumar, Sharma,	Jai Prakash Nath and Co	2000

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	S	S	S
CO2	S	M	M
CO3	M	S	S
CO4	S	M	M

CORE - IX	M.Sc - PHYSICS	2019 – 2020
M19PPH09	STATISTICAL MECHANICS	
CREDITS: 4		

Objectives

The present course completely deals about the distributions of the particles in n number of ways through mid way Physics so called as Statistical Mechanics.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Distinguish classical and statistical mechanics	K1
CO2	Discuss the hypothesis of Statistical mechanics	K2
CO3	Give the various distributions present in statistical mechanics	K3
CO4	Discuss the applications of Statistical Mechanics	K4

Unit – I Classical Statistical Mechanics

Phase space and ensembles – Types of ensembles - Liouville's theorem – Statistical Equilibrium –Thermal Equilibrium- Elementary ideas of Partition Functions-Connection between Statistical and Thermodynamical quantities - Micro and macro states - Maxwell - Boltzmann distribution law - Distribution of energy and velocity - Principle of equipartition of energy - Boltzmann's entropy relation.

Unit – II Kinetic Theory

Binary collisions - Boltzmann transport equation and its validity - Boltzmann's H-theorem and its analysis – Poincare's theorem – Transport phenomena: Mean free path - Zero order approximation - Viscosity of a gas - Navier - Stokes equation - Application to Incompressible fluids.

Unit – III Entropy and Thermodynamics

Entropy - Principle of entropy increase – Entropy and Disorder– Change in Enrtopy for reversible and irreversible processes - Gibbs paradox – Resolution of the paradox – Sackur – Tetrode equation –Thermodynamic Potentials and Reciprocity relations-– Nernst Heat Theorem.

Unit – IV Quantum Statistics

Ideal Bose Systems – Photon gas – Radiation pressure and density - Bose - Einstein condensation – Debye's model of solids: Phonon gas - Ideal Fermi Systems – Fermi energy – Mean energy of Fermions – Electron gas in metals - Thermionic emission - Pauli Para magnetism.

Unit – V Advanced Topics in Statistical Mechanics

Phase transition- Order of phase transitions-First and second order- Interaction of spin in Ferromagnetism- Weiss molecular field approximation— General formulism of Ising model - One dimensional Ising model - Fluctuations- Mean Square deviation- Brownian motion- Expression for Brownian motion- Fourier Analysis of random function: Weiner- Khinchine theorem.

BOOKS FOR STUDY AND REFERENCE

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Fundamentals of Statistical Mechanics	B.B.Laud	New Age International Publishers, New Delhi,	2007.
2	Statistical Mechanics	Kerson Huang	Wiley eastern Ltd., New Delhi,	1983
3	Statistical Mechanics	B.K. Agarwal and M. Eisnor	New Age International Publishers, 2nd Edition.	1993
4	Elementary Statistical Mechanics	Gupta and Kumar, Pragati Prakashan,	Meerut, 8th Edition.	1981

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	M	S	S
CO2	M	S	M
CO3	S	S	M
CO4	S	S	M

CORE - X	M.Sc- PHYSICS	2019– 2020
M19PPH10	COMPUTATIONAL METHODS AND PROGRAMMING	
CREDITS: 4		

Objectives

The present title gives applications of programs for the development of Physics and for theoretical applications. It covers C++ programming, curve fitting and Linear and non linear equations etc.,

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Familiar with computer programmings	K1
CO2	Summarize Curve fittings and interpolations	K2
CO3	Analyze Linear and Non linear solutions	K3
CO4	Apply solutions to various types of differential equations	K4

UNIT - I : C++ programming

Constants, variables and their declarations - Input, output and comparison operators-if, if. else, switch, while, do-while, for, break statements- main, void, exit, swap functions- Arrays passing by value and passing by reference.

UNIT - II : Curve fitting and interpolation

Curve fitting: Method of least squares- Normal equations- Straight line fit-Exponential and power-law fits. Newton interpolation polynomial: Linear Interpolation- Higher-older polynomials-First-order divided differences-Gregory-Newton interpolation polynomials-Lagrange interpolation - Truncation error.

UNIT - III : Solutions of Linear and Nonlinear Equations

Simultaneous linear equations: Gauss elimination method -Jordan's modification-Inverse of a matrix by Gauss- Jordon Method - Roots of nonlinear equations: Newton-Raphson method - Iterative rule - Termination criteria - Pitfalls - Order of convergence

UNIT - IV : Numerical integration and Differentiation

Newton-Cotes quadrate formula - Trapezoidal, Simpson's 1/3 and 3/8 rules - Errors in the formulas. Differentiation: First -order derivative:-Two and four-point formulas second-order derivative: Three and five-point formulas.

UNIT - V : Numerical solution to ordinary Differential Equations

First-order equations: Euler and improved Euler methods-Formulas-Local and global truncation errors-Fourth-order Runge-Kutta method-Geometric description of the formula-Errors versus step size -Second order equation- Euler methods and Fourth order Runge-Kutta method.

BOOKS FOR STUDY AND REFERENCE

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Programming with C++,	J. R. Hubbard,	McGraw-hill, New Delhi,	2006.
2	Numerical Methods for Mathematics, Science and Engineering,	J. H. Mathews,	Prentice-Hall of India, New Delhi,	1998
3	Numerical Methods for Scientific and Engineering Computation,	M. K. Jain S.R.K Iyengar and R.K.Jain, -	New Age International, New Delhi,	1993
4	Elementary Numerical Analysis, 3rd Ed,	D. Conte and C.Boor,	McGraw Hill,Singapore,	1981

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	M	S	S
CO2	S	M	S
CO3	M	M	S
CO4	S	S	M

CORE - XI	M.Sc - PHYSICS	2019 – 2020
M19PPH11	ELECTROMAGNETIC THEORY	
CREDITS: 4		

Objectives

It provides the detailed idea about Electromagnetic waves with Maxwell's equations. It also deals electrostatics along with magneto statics in detail with applications. In addition with the above it introduces Plasma Physics to the students.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Know about electrostatics and magnetostatics with basic principles	K1
CO2	Understand the connection between electricity and magnetism with equations	K2
CO3	Discuss about the role of electromagnetic waves to unleash the puzzles of Physics	K3
CO4	Elaborate the concepts EMT for Plasma Physics	K4

UNIT - I : Electrostatics

Coulomb's Law - Electric field intensity - Field due to point and continuous charges -Gauss' Law and its applications- Gauss's law and application - Electric potential - Electric field and equipotential plots. Electric field in free space, conductors, dielectric -Dielectric polarization - Dielectric strength - Electric field in multiple dielectrics- Molecular polarisability and electric susceptibility-Electrostatic energy in dielectric medium- Clausius-Mossotti equation Laplace and Poisson equations, boundary value problems.

UNIT - II : Magnetostatics

Lorentz Law of force, magnetic field intensity - Biot-savart Law - Ampere's Law -Magnetic field due to straight conductors, circular loop, infinite sheet of current -Magnetic flux density (B) - B in

free space, conductor, magnetic materials -Magnetization- agnetic field in multiple media - Boundary conditions - Scalar and vector potential- Magnetic force - Torque - Inductance- Energydensity - Magnetic circuits.

UNIT - III : Electrodynamic fields

Faraday's laws, induced emf - Transformer and motional EMF - Forces and Energy in quasi-stationary Electromagnetic Fields - Maxwell's equations (differential and integral forms) - Displacement current- Relation between field theory and circuit theory. Vector and scalar potential- Gauge transformation- Lorentz gauge- Coulomb gauge Conservation laws for a system of changes- Poynting theorem.

UNIT - IV : Electromagnetic waves

Generation - Electro Magnetic Wave equations - Wave parameters; velocity, intrinsic impedance, propagation constant - Electromagnetic waves in free space, dielectrics, and conductors; Reflection and refraction, polarization, Fresnel's Law, interference, coherence, and diffraction; Dispersion relations in plasma skin depth, Poynting vector Wave guides-Propagation of waves in a rectangular wave guide-inhomogeneous wave equation and retarded potentials field and radiation due to an oscillating electric dipole.

UNIT - V : Plasma physics

Definition of plasma; Its occurrence in nature; Dilute and dense plasma; Uniform but time-dependent magnetic field: Magnetic pumping; Static non-uniform magnetic field: Magnetic bottle and loss cone; MHD equations, Magnetic Reynold's number; Pinched plasma; Bennett's relation; Qualitative discussion on sausage and kink instability.

BOOKS FOR STUDY AND REFERENCE:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Elements of Electromagnetics	Mathew N. O. Sadiku	Oxford University press Inc. First India edition,	2007
2	Electromagnetism - Theory and Applications	Ashutosh Pramanik,	Prentice-Hall of India Private Limited, New Delhi,	2006
3	Introduction to Electromagnetics- III Edition	David J Griffiths -	Prantice Hall of India Pvt.Ltd.- New Delhi,	2000
4	Foundations of Electromagnetic Theory-VI Edition	J.Milman and C.C. Halkias	Narosa Publishing House, New Delhi	2000

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	S	S	S
CO2	S	M	M
CO3	M	S	S
CO4	S	M	M

Elective - III	M.Sc- PHYSICS	2019– 2020
M19PPHE07	NANO PHYSICS	
CREDITS: 4		

Objectives

Bearing in mind the role of the applications of recent technologies The present course deals about the innovations of Nano science and Technology. Also it deals about the Physical and chemical properties of Materials in Nanoscale level.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Remember the differences between chemical and physical properties	K1
CO2	Understand the techniques involved in the synthesis of nanomaterials	K2
CO3	Analyze nanomaterials using various characterization techniques	K3
CO4	Apply studied theories for various applications which lying in Nanoscale level	K4

UNIT I : Basic Properties of Nanoparticle

Particle size; Top down and bottom up ideas, particles shape; Size effect and properties of nano-particles; Particle density; Melting point; Surface tension; Wettability; Specific surface area and pore; Composite structure; Crystal structure;Surface characteristics; Mechanical properties; Electrical properties; Magneticproperties; Optical properties; Concept of vacuum technology.

UNIT II : Quantum Phenomen

One dimensional quantum or electron leak; Quantized electron energy; Time dependent perturbati on theory; Transi ti on to conti nuum (Fermi ' s Gol den rule);Density of states (DOS); Spin effects (Kondo resonance, Zeeman splitting) spectroscopy.

UNIT III : Nanofabrication and Nanopatterning

Sol-Gel synthesis, Hydrothermal Growth, Optical, X-ray, and electron beam lithography, self -assembled organic layers, scanning tunneling microscopy, atomic force microscopy.

UNIT IV : Nano Systems

An artificial and tunable atom (quantum dot); Quantum wire; Quantum Hall effect; Carbon nano-tube; Tunnel diode; Molecular transistor; Single electron transistor;Spin polarized transistor; Thin films; Self assembly.

Unit V : Applications of Nanomaterial

Optoelectronic properties of molecular materials, nanotechnology devices: OLEDs, OTFTs. Bioelectronics and biosensors: charge transport, DNA and protein functional systems, electronic noses and biosensors.

BOOKS FOR STUDY & REFERENCE:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Scanning Probe Microscopy and Spectroscopy – Methods and Applications	Roland Wiesendanger	Cambidge University Press	1994
2	The Physics and Chemistry of Materials	Joel I. Gersten, Frederick W. Smith	John Wiley and Sons	2001
3	Applied Scanning Probe Methods IX Characterization	Bhushan Bharat, Fuchs Harald, Tomitori Masahiko	Springer	2008
4	Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience Second Edition,	E. Wolf	Wiley-VCH	2006

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	S	S	M
CO2	M	M	S
CO3	S	M	M
CO4	M	M	M

Elective - III	M.Sc - PHYSICS	2019 – 2020
M19PPHE08	MEDICAL PHYSICS	
CREDITS: 4		

Objectives

The elective course will be the basic platforms for researchers and students towards the applications of Physics in Medical Sciences.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Remember Bio electric signals	K1
CO2	Understand the mechanism of transducers	K2
CO3	Analyze measurements in human through electro neurography	K3
CO4	Apply Physics Laws with the endoscopes, X-ray etc.,	K4

Unit-I: Bio electric signals – electrodes – surface. Needle and microelectrodes, Bio-Sensors – pulse sensor.

Unit – II: Transducers: thermister, photo electric type – transducer – photo voltaic cells – photo emission cells – diode – detectors – optical fibers.

Unit –III: Blood pressure measurement: sphygmomanometer measurement of heat rate – basic principles of ECG - basic principles of electro neurography – ENG – principle of MRI

Unit – IV: Basic X-ray production of X-ray, X-ray image application of X-ray, Examination. Basic principle of X-ray tomography.

Unit-V: Endoscopes – thermography - Liquid crystal – Thermography - Microwave thermography – Basic principles of ultra sonography – laser – uses of laser in medicine.

BOOKS FOR STUDY AND REFERENCE

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Radiation Physics for Medical Physicists	E.B.Podgarsak	Springer	1996
2	The Physics of radiology	H.E.Johns and Cunningham	Charles C Thomas Publishers	2000

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	S	S	S
CO2	M	M	M
CO3	M	S	M
CO4	S	M	S

Elective -III	M.Sc- PHYSICS	2019– 2020
M19PPHE09	OPTO ELECTRONICS	
CREDITS: 4		

Objectives

The present core course is considered as one of the most unique research course in Physics and will be basic platforms for researchers and scientists.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Familiar with Optical concepts and their forms based on electron propagation	K1
CO2	Understand the concepts of active and passive devices	K2
CO3	Discuss the function of fibre optical communication	K3
CO4	Extend optoelectronics for optical and sensor applications	K4

UNIT I : Introduction

Propagation of electromagnetic waves in dielectric wave guides – fibers – boundary conditions – phase velocity and group velocity – Dispassion – cut off frequencies – EM field in core and cladding – single mode and multimode fibers.

UNIT II : Active Devices

LED's lasers – Laser principles – spontaneous and stimulated emission – coherence – gain equation – three level, four level lasers- examples of lasers (He-Ne) Ruby, diode –homojunctioin and heterojunction diode lasers.

UNIT III : Fibre Optics Communication

LED and lasers source – Transmitter modulator – acousto – optic, electro optic
modulator – AM, FM, DCM modulation – detection and demodulation radiation
detection – PIN, APD and PM tube.

UNIT IV : Optical Fiber Sensors

General features, types of OFS, intrinsic and extrinsic sensors, intensity sensors, shuttes based multimode OFS, simple fiber based sensors for displacement,temperature and pressure measurements – reflective OFS and applications, Fiber Bragg grating based sensors.

UNIT V : Interferometric FOS

Basic principles, interferometric configurations, Mach – Zendes. Michelson and Fabry – Perrot configurations – components and construction of interferometric FOS,applications of interferometric FOS, Sagnac interferometer, fibers gyro, OTDR and applications.

BOOKS FOR STUDY & REFERENCE:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Planar Optical Waveguides and Fibres, Oxford	H.G. Unger,	Oxford University Press	1977
2	Principles of Optical Electronics,	A. Yariv	John Wiley, New York	1984
3	Waves and Fields in Optoelectronics	H.A. Haus	Prentice Hall, New Jersey	1984
4	Optics, Second Edition	Ajoy Ghatak,	Tata McGraw Hill,	2013

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	M	S	S
CO2	S	S	S
CO3	M	S	M
CO4	M	M	S

SEMESTER-IV

CORE - XII	M.Sc - PHYSICS	2019 – 2020
M19PPH12	CONDENSED MATTER PHYSICS	
CREDITS: 4		

Objectives

The present core course is considered as one of the most unique research course in Physics and will be basic platforms for researchers and scientists.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Familiar with crystallographic concepts and their bondings	K1
CO2	Understand the lattice vibrations and thermal properties in crystal systems	K2
CO3	Discuss in detail about various theories involving to understand matters in detail	K3
CO4	Elaborate magnetic, dielectric and superconducting behaviors in detail	K4

UNIT - I : Crystallography and Bonding

Reciprocal lattices - Vector development of reciprocal lattice - Properties of the reciprocal lattice - Reciprocal lattice to bcc lattice and fcc lattice - Bragg's condition in terms of reciprocal lattice – Crystal diffraction- Neutron and electron diffraction - Brillouin zones. Binding energy of ionic crystals - Madelung constant - Cohesive energy. Crystals of inert gases - Vanderwaal's interaction - London interaction - Cohesive energy.

UNIT - II : Lattice Vibrations and Thermal properties

Vibration of monoatomic lattices- Lattices with two atoms per primitive cell- Quantization of lattice vibrations- Phonon momentum - Inelastic scattering of neutrons by phonons. Lattice heat capacity - Einstein model - Density of mode in one-dimension and three- Dimension - Debye model of the lattice heat capacity -Thermal conductivity - Umklapp process.

UNIT - III : Free Electron theory, Energy Bands and Semiconductor Crystals

Energy levels and density of orbitals - Fermi-Dirac distribution - Free electron gas in three dimensions - Heat capacity of the electron gas - Electrical conductivity and Ohm's law – Motion in magnetic fields - Hall effect - Thermal conductivity of metals - Nearly free electron model - Electron in a periodic potential - Semiconductors - Band gap - Effective mass -Intrinsic carrier concentration.

UNIT - IV : Diamagnetism, Paramagnetism, Ferromagnetism and Antiferromagnetism

Langevin classical theory of Diamagnetism and Paramagnetism- Weiss theory- Quantum theory of Paramagnetism - Demagnetization of a paramagnetic salt - Paramagnetic susceptibility of conduction electrons - Hund's rules- Kondo effect. Ferroelectric order – Curie point and the exchange integral- Thermal excitation- Ferromagnetic order- Antiferromagnetic order -Antiferromagnetic Magnons - Ferromagnetic domains - Origin of domains - Coercive force and hysteresis.

UNIT - V : Dielectrics, Ferroelectrics and Superconductivity

Macroscopic electric field- Local electrical field at an atom- Dielectric constant and Polarizability - Classius-Mossotti equation - Ferroelectric domains. Occurrence of Superconductivity - Meissner effect - Thermodynamics of Superconducting transition- London equation- Coherence length- BCS theory - Flux Quantization - Type-I and Type-II Superconductors -Josephson tunneling effect- DC and AC Josephson effect- SQUID - Recent developments in high Temperature Superconductivity- Application of superconductors.

BOOKS FOR STUDY AND REFERENCE

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Solid State Physics	S.L.Gupta & Dr.V.Kumar.	Vikas publishing Ltd	1978
2	Introduction to Solid State Physics	C. Kittel	Wiley Eastern	1977
3	Solid State Physics	S. O. Pillai	New Age International (p) Ltd, New Delhi	1959
4	Solid State Physics	A. J. Dekker	Mac Millen, Madras	1971

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	M	M	S
CO2	M	S	M
CO3	S	M	M
CO4	S	S	S

CORE - XIII	M.Sc- PHYSICS	2019– 2020
M19PPH13	NUCLEAR AND PARTICLE PHYSICS	
CREDITS: 4		

Objectives

Nuclear and particle Physics course deals in detail about the structure and properties of the nucleus through various models and theories. It also gives the basic ideas about nuclear interactions, reactions, decays and about elementary particles.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Remember the models of nucleus and elementary particles	K1
CO2	Understand the reactions and interactions between the nucleus	K2
CO3	Familiar in nuclear decays and elementary particles and their classifications	K3
CO4	Apply various models and theories to understand nuclear structure	K4

Unit - I : Nuclear Structure

Distribution of nuclear charge - spin and magnetic moment - determination of nuclear mass - Binding Energy - Nuclear stability - Mass parabolas - Nuclear Shell model - Liquid drop model - Optical Model - Collective Model.

Unit - II : Nuclear Interactions

Exchange forces - Yukawa's meson theory - Yukawa potential - Ground state of deuteron - Low energy n-p scattering - effective range - spin dependence and charge independence of nuclear forces.

Unit - III : Nuclear Reactions

Types of reactions and Energetics of nuclear reactions - conservation laws - Q Value - Scattering and reaction cross sections - Compound nucleus - Reciprocity theorem - Breit and Wigner Dispersion formula - stripping and pickup reactions.

Unit - IV : Radioactive Decays

Alpha decay - Geiger - Nuttal law - Gamow's Theory - Neutrino hypothesis - Fermi theory of beta decay - Selection rules - Gamma decay - Selection rules - Internal conversion

Unit - V : Elementary Particles

Types of interactions between elementary particles - Leptons - Hadrons - Mesons - Hyperons -Pions - Gell - Mann Okubo mass formula for octet and decaplet - SU(2) - SU(3) Multiplet - Quark model - Color and flavor - weak and strong interactions.

BOOKS FOR STUDY AND REFERENCE

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Nuclear Physics,	R.P. Roy and B.P. Nigam	Age International Ltd, New Delhi	2005
2	Concepts of Nuclear Physics	B.L. Cohen,	Tata McGraw Hill, New Delhi,	1983
3	Introduction to Atomic and Nuclear Physics	H.Semat,	Chapman and Hall, New Delhi	1983
4	Nuclear and particle Physics	W.S.C Williams ,	Claredon Press, London,	1981

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	S	S	M
CO2	M	S	M
CO3	M	M	S
CO4	M	M	S

CORE - XIV	M.Sc- PHYSICS	2019– 2020
M19PPH14	SPECTROSCOPY	
CREDITS: 4		

Objectives

The present title gives brief ideas about molecular, rotational and vibration spectroscopy. It also offers the principle and instrumentations of each spectroscopic technique in brief.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Know about vibrational, rotational and molecular spectroscopic techniques	K1
CO2	Understand the mechanisms of rotational and molecular spectroscopic techniques	K2
CO3	Identify the suitability of each spectroscopic techniques	K3
CO4	Apply these spectroscopic techniques for qualitative and quantitative analyses of the molecules	K4

UNIT - I : IR - Spectroscopy

Principle and theory of Infrared spectroscopy - Far and Near IR absorption spectroscopy - Mid and Near IR reflectance spectroscopy- Photo acoustic IR spectroscopy - Dispersive IR spectrometer - IR Imaging - FT - IR spectroscopy - Vibrational frequencies and qualities analysis - sampling methods - Instrumentation- Applications.

UNIT - II : Raman Spectroscopy

FT Raman spectroscopy - degree of depolarization - structure determination using IR and Raman spectroscopy - Resonance Raman spectroscopy - Coherent anti - Stokes Raman spectroscopy - Inverse Raman and surface Enhanced Raman spectroscopy - principles, techniques and applications - non - linear Raman spectroscopy.

UNIT - III : Electronic Spectra : Florescence & Phosphorescence Spectroscopy Electronic Excitation of Diatomic Species - Vibrational Analysis of Band Systems of Diatomic Molecules - Deslandre's Table - Intensity Distribution - Franck Condon Principle - Rotational Structure of Electronic Bands - Resonance and Normal Fluorescence - Intensities of Transitions - phosphorescence Population of Triplet State and Intensity - Experimental Methods - Applications of Florescence and Phosphorescence.

UNIT - IV : NMR & NQR Spectroscopy

NMR Spectroscopy : Quantum Mechanical and Classical Description - Bloch Equation - Relaxation Process - Experimental Technique - Principle and Working of High Resolution NMR Spectrometer - Chemical Shift NQR Spectroscopy : Fundamental Requirements - General Principle - Experimental Detection of NQR Frequencies - Interpretation and Chemical Explanation of NQR Spectroscopy.

UNIT - V : ESR & Mossabauer Spectroscopy

ESR Spectroscopy : Basic Principles - Experiments - ESR Spectrometer - Reflection Cavity and Microwave Bridge - ESR Spectrum - Hyperfine Structure Mossabauer Spectroscopy : Mossabauer Effect - Recoilless Emission and Absorption - Mossabauer Spectrum - Experimental Methods - Hyperfine Interaction - Chemical Isomer Shift - Magnetic Hyperfine and electric Quadrupole Interaction.

BOOKS FOR STUDY AND REFERENCE

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Fundamentals of Molecular Spectroscopy	C.N. Banwell,.	Tata MCGraw Hill	1972
2	Spectroscopy Vol. 1,	B.P. Straughan and Walkar, ,	Chapman and Hall	1976
3	Basic Principles of Spectroscopy	D.N. Sathyanarayana -	New Age International Publications	2004
4	Basic Principles of Spectroscopy	Raymond Chang,	McGraw Hill Koyakusha Ltd	1980

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	S	S	S
CO2	S	M	M
CO3	M	M	M
CO4	M	S	M

Elective - IV	M.Sc- PHYSICS	2019– 2020
M19PPHE10	CHARACTERIZATION OF MATERIALS	
CREDITS: 4		

Objectives

The present elective course focuses on characterization of materials in order to know the suitability of the materials for specific applications. It describes in detail completely about crystal growth, thin film technology, XRD, UV etc., and their applications.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Remember crystals and their growth technologies	K1
CO2	Familiarize with thin film technology	K2
CO3	Analyze suitable characterization techniques based on the choice of the materials and applications	K3
CO4	Apply these technologies in MEMS and R&D	K4

UNIT - I : Nucleation and Growth

The crystalline state - concept of crystal growth - historical review - Importance of crystal growth - crystal growth theory : classical theory - Gibbs - Thomson equation- kinetic theory of nucleation - Energy of formation of a nucleus - kinetics of thin film formation - Film growth - five stages - Nucleation theories - In corporation of defects and impurities in films - Deposition parameters and grain size - structure of thin films.

UNIT - II : Growth Techniques

Solution growth technique : low temperature solution growth : solution - Solubility -constant temperature bath an crystallizer - seed preparation and mounting - slow cooling and solvent evaporation methods. Gel growth technique : Principle - various types - structure of gel - Importance of gel -

Experimental procedure - Advantage of gel method. Melt technique : Bridgman technique - czochralski technique - Experimental arrangement - Growth process. Vapous technique: physical vapour deposition - chemical vapour deposition (CVD) - chemical vapour transport.

Unit - III: Thin Film Deposition Techniques

Thin films - Introduction to vaccum technology -deposition techniques - physical methods - resistive heating , electron beam cun and laser gun evaporation - sputtering : Reactive sputtering , radio frequency sputtering - chemical methods - spray pyrolsis - reparation of transport conducting oxides.

Unit - IV : Characterization Technique

X-ray Diffraction (XRD) - power and single crystal - fourier transform infrared analysis - FT -Raman analysis - Elemential dispersive x-ray analysis (EDAX) - scanning electron microscopy (SEM) - UV -VIS Spectrometer Vickers micro hardness - Auger emission spectroscopy. Photolumine scene (PL) - UV -Vis -IR spectrometer- AFM- Hall effect - SIMS - X-ray - photoemission spectroscopy (XPS) - dynamic light scattering - ellipsmety method.

Unit - V : Applications

Micro electrochemical systems (MEMS) - optoelectronic devices : LED , LASER and solar cell - polymer films - Fabrication and characterization of thin film transistor, capacitor , resistor , inductor and FET - Sensor - quantum dot - Applications of ferromagnetic and super conducting films : Data storage , Giant magneto resistance (GMR).

BOOKS FOR STUDY AND REFERENCE

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Elementary crystal growth	K.Sangawal	shan publisher , UK	1994
2	Crystal Growth and processes.	P.Santhana Ragavan, P.Ramasamy	KRU publications. Kumbakonam	2000
3	Crystal Growth Process	J.C.Brice	John wiley publications	1996
4	Hand book of thin films Technology	L I Maissel and R clang	Mc Graw - Hill	1970

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	M	S	S
CO2	M	M	S
CO3	S	S	M
CO4	M	S	S

Elective -IV	M.Sc- PHYSICS	2019 – 2020
M19PPHE11	ENERGY PHYSICS	
CREDITS: 4		

Objectives

It gives a brief idea about various types of renewable and non renewable energy sources. At the end of this course the students are able to understand the concepts of energy sources and the storage technologies.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Receive the concepts of renewable and non renewable energy sources	K1
CO2	Familiarize with different types of solar cells	K2
CO3	Discuss about the applications of solar cells	K3
CO4	Apply these technologies in wind and bio mass technologies	K4

UNIT I : Introduction to Energy Sources

Energy sources – Types of energy sources – World energy futures- Energy sources and their availability – Prospects of renewable energy sources.

UNIT II : Solar Cells

Solar Cells: Solar cells for direct conversion of solar energy to electric powers – Solar cell parameter – Solar cell electrical characteristics – Efficiency – Single crystal silicon solar cells – Polycrystalline silicon solar cells – Cadmium sulphide solar cells.

UNIT III : Applications of Solar Energy

Solar water heating – space heating and space cooling – solar photo voltaics –
agricultural and industrial process heat – solar distillation – solar pumping– solarfurnace – solar cooking – solar green house.

UNIT IV : Wind Energy

Base principles of wind energy conversion wind data and energy estimation – Base components of wind energy conversion systems (WECS) types of wind machines –Generating systems – scheme for electric generation – generator control – load control– applications of wind energy.

UNIT V : Energy from Biomass

Biomass conversion Technologies – wet and Dry process – Photosynthesis-iogas

Generation: Introduction – basic process and energetic – Advantages of anaerobic digestion – factors affecting bio digestion and generation of gas – Classification of Biogas plants: Continuous and batch type – the done and drum types of Bio gas plants – biogas from wastes fuel – properties of biogas – utilization of biogas.

BOOKS FOR STUDY AND REFERENCE

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Principles of Solar Engineering	F. Kreith and J.F. Kreider	Tata McGraw Hill	1978
2	Applied Solar Energy,	A.B. Meinel and A.P.Meinel,	Addison Wesley Publishing Co.	1976
3	Solar Energy	M.P.Agarwal	S. Chand and Co., New Delhi	1983
4	Solar Energy	S.P.Sukhatme	Tata McGraw Hill	1997

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	S	S	S
CO2	S	M	M
CO3	S	S	M
CO4	M	M	M

Elective -IV	M.Sc- PHYSICS	2019– 2020
M19PPHE12	COMMUNICATION ELECTRONICS	
CREDITS: 4		

Objectives

It gives a brief idea about various communication technologies being used by the people in various sectors.

Course outcomes

On the successful completion of the course, students will be able to

CO	Statement	Knowledge Level
CO1	Receive the concepts of transmission and reception in communication technology	K1
CO2	Familiarize with codes and digital signals	K2
CO3	Discuss about microwaves for communication purpose	K3
CO4	Apply these technologies in RADAR & TV	K4

UNIT - I : Antennas & Wave Propagation

Radiation field and Radiation resistance of a short dipole antenna -Grounded λ /4 Antenna-Ungrounded λ /2 Antenna- Antenna Arrays-Broadside and End Side Arrays-Antenna Gain-Directional High Frequency Antennas- Sky Wave Propagation-Ionosphere-Ecles & Larmor Theory-Magneto Ionic Theory-Ground Wave Propagation.

UNIT - II : Pulse Code and Digital Modulation Techniques

Sampling theorem - Low - Pass and Band - Pass signals, PAM, Channel BW for a PAM signal. Natural sampling. Flat-top sampling, Signal recovery through Holding, Quantization of signals, PCM transmission, quantization of noise, differential PCM Delta Modulation, Adaptive Delta modulation, CVSD. Signal to noise ratio in PCM and Delta Modulations - ASK, FSK, BPSK, DPSK, QPSK, QASK, MSK and QAM.

UNIT - III : Microwaves(Operation only)

Microwave Generation-Multicavity Klystron-Reflex Klystron-Magnetron-Travelling WaveTubes (TWT) and other Microwave Tubes-MASER-Gunn Diode. Broad Band Communication Systems Multiplexing - Frequency division - Time division. Short and medium Haul systems: Coaxial cables - fibre optic link - Microwave link - Tropospheric Scatter links. Long Haul system: Submarine cables.

UNIT - IV : Radar and Television

Elements of a Radar System-Radar Equation-Radar Performance Factors-Radar Transmitting Systems- Radar Antennas-Duplexers-Radar Receivers and Indicators-Pulsed Systems-Other Radar Systems. Colour TV Transmission and Reception - Colour mixing principle - Colour Picture Tubes -Delta Gun picture tube - PIL colour picture tube - Cable TV, CCTV and Theatre TV.

UNIT - V: Optical Fibres

Propagation of Light in an Optical Fibre-Acceptance Angle-Numerical Aperture-Step and Graded Index Fibres-Optical Fibre as a Cylindrical Wave Guide-Wave Guide Equations-Wave Equations in Step Index Fibres- Fibre Losses and Dispersion-Applications. Satellite communication Orbital Satellites, Geostationary Satellites, Orbital Patterns, satellite system link models, satellite system parameters, satellite system link equation, Link budget. INSAT communications satellites.

BOOKS FOR STUDY & REFERENCE:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Electronic Communication System	George Kennedy & Davis	Tata McGraw Hill 4th edition.	1989
2	Principles of Communication Systems	Taub and schilling,	Second edition, Tata McGraw Hill	1991
3	Electronic Communications	Dennis Roddy & Coolen	Prentice Hall of India	1995
4	Advanced electronics communication Systems	Wayne Tomasi	Prentice Hall, Inc.,	1998

Mapping with Programme Outcomes

COs	PO1	PO2	PO3
CO1	M	S	M
CO2	S	M	S
CO3	M	M	M
CO4	S	M	M

CORE PRACTICAL – I	M.Sc- PHYSICS	2019– 2020
M19PPHP01	PRACTICAL–I GENERAL PHYSICS EXPERIMENTS – I	
CREDITS: 3		

ANY FIFTEEN EXPERIMENTS

1. Young's modulus – Elliptical fringe method.
2. Young's modulus – Hyperbolic fringe method.
3. Determination of Stefan's constant.
4. Determination of Rydberg's constant – Hydrogen spectrum and Solar spectrum.
5. Determination of resistivity of a semiconductor by Four Probe Method.
6. Measurement of Hall Coefficient of the semiconductor.
7. Determination of band gap in a semiconductor material.
8. B.H. Curve – Anchor ring.
9. Thermistor – Determination of Temperature coefficient and band gap energy.
10. Fabry – Perot Etalon using spectrometer.

CORE PRACTICAL - II	M.Sc- PHYSICS	2019– 2020
M19PPHP02	PRACTICAL- II ELECTRONICS EXPERIMENTS	
CREDITS: 3		

ANY TWENTY EXPERIMENTS

1. Construction of single stage and multi stage RC coupled transistor amplifier.
2. Characteristics of JFET and Construction of JFET amplifier.
3. Characteristics of Silicon Controlled Rectifier.
4. Study the characteristics of UJT and construction of UJT Relaxation oscillator.
5. Study the characteristics of DIAC and TRIAC.
6. Characteristics of Tunnel diode and Gunn diode.
7. Characteristics of LED and Photo diode.
8. Laser diode and Photo transistor characteristics.
9. Design of Schmit Trigger and Construction of Astable multivibrator circuit using IC 555 and IC 741.
10. Design and study of monostable and bistable multivibrator circuits using IC 555.
11. Construction of adder, subtractor, differentiator and integrator circuits using IC 741.
12. Design of second order Butter worth active filter circuits: low pass, high pass, band pass and band rejection using IC 741.
13. Design of square wave, saw tooth wave and triangular wave generators using IC 741.
14. Construction of D/A converter – R-2R method and Binary weighted method.
15. Construction of A/D converter using comparator and study its performance.
16. Construction of half adder and full adder circuit using NAND gates.
17. Construction of half subtractor and full subtractor circuits using NAND gates.
18. V-I Characteristics of a Solar Cell.
19. Flip flops – RS, JK, Master Slave and T flip flops.
20. Study of Counters: Ripple, MOD 3, MOD 5 Counters.
21. BCD and UP/ DOWN Counters.
22. Construction of Shift registers using IC 7476: serial in - serial out, parallel in - parallel
out, shift left and shift right.
23. Analog computer circuit design – solving simultaneous equations.
24. Multiplexer and Demultiplexer.
25. Decoders and Encoders.

CORE PRACTICAL – III	M.Sc- PHYSICS	2019– 2020
M19PPHP03	PRACTICAL–III GENERAL PHYSICS EXPERIMENTS – II	
CREDITS: 3		

1. Determination of magnetic susceptibility of liquid by Guoy's method.
2. Determination of susceptibility of a paramagnetic solution by Quincke's method.
3. Charge of an Electron by spectrometer.
4. Determination of wavelength of a laser by Michelson Interferometer method.
5. Compressibility of a Liquid using Ultrasonic interferometer.
6. Solar spectrum – Hartmann's Interpolation formula.
7. Permitivity of a liquid using R.F.Oscillator.
8. Determination of (i) thickness of a wire (ii) diameter of a circular aperture (iii) wavelength of He-Ne laser / diode laser using diffraction grating.
9. Determination of refractive index of the liquids using He-Ne / Laser.
10. Determination of numerical aperture of an optical fiber.
11. G.M. Counter –Characteristics and Inverse square law.
12. Zeeman Effect – e/m of an electron with a laser source.
13. Iron / Copper arc spectrum.
14. Brass / Alloy arc spectrum.
15. AlO / CN band spectrum.

CORE PRACTICAL - IV	M.Sc- PHYSICS	2019– 2020
M19PPHP04	PRACTICAL - IV MICROPROCESSOR AND MICROCONTROLLOR EXPERIMENTS	
CREDITS: 3		

MICROPROCESSOR (8085)

1. 16 bit Addition, Subtraction, Multiplication and Division.
2. Number conversion: (i) BCD to Binary (ii) Binary to BCD (iii) ASCII to HEX (iv) HEX to ASCII using 8085.
3. Ascending and descending order of numbers.
4. Square and square root of a given number.
5. Factorial of a given number and largest and smallest number in a set of numbers.
6. ADC and DAC Interfacing.
7. Digital Thermometer.
8. Stepper Motor Interface.
9. Traffic Light Control Interface.
10. Digital Clock.

MICROCONTROLLER (8051)

1. 16 bit Addition, Subtraction, Multiplication and Division.
2. Generation of square, triangular, saw tooth, staircase and sine waves.
3. DC Motor Control Interface.
4. HEX key board Interface.
5. Switching an array of LED'S.

EDC -	M.Sc. Physics	2019 - 2020
M19EPH01	GEOPHYSICS	
Credit: 4		

UNIT I :

Origin of Earth Petrology – Evolution and composition of earth – Major subdivisions of earth's Sphere – Atmosphere – Hydrosphere – Lithosphere – Interior of earth – Composition of earth crust - Relative abundance of earth's crust.

UNIT II :

Geomagnetism Origin of earth's magnetism – elements of earth's magnetic field – inclination, declination and dip- earth's magnetic field – Diurnal, annual and secular variations – magnetosphere.

UNIT III :

Seismology Basic principles of elasticity and wave motion – primary wave (P-waves) and elasticity wave (S- wave) – density within the earth – pressure distribution – variation of 'g' and elastic constants - earth quakes – Elementary ideas about Ritter's scale.

UNIT IV :

Geo - Thermal Effect Fundamental concept of Thermal conductivity – heat flow measurement on ground level and ocean – heat flow gravity variation – temperature of the primitive earth – inner core – melting point – adiabatic temperature gradient.

UNIT V :

Gravimetry Fundamental concepts of gravitational field – gravitational anomalies – use of gravitational anomalies in geophysical prospecting – petroleum and mineral survey – factors affecting gravitational field due to magnetic storms and cosmic ray showers - Hammond and Faller method of absolute gravity measurement – principle and working.

TEXT BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Pedology, Concept and Applications	J.Sehgal	Kalyani publishers	2008
2	Introduction to Geophysics.	George G. Garland	W.B.Saunder's company	2007
3	Physics and Geology, Jacobbs	Russel and Wilson	International Students Edition, Tata McGraw Hill	2003

REFERENCE BOOKS:-

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Rock Magnetism,	Nagata	McGraw Hill Publications	2005
2	Geology, McGraw Hill Publications,	Debrin	McGraw Hill Publications	2010

EDC -	M.Sc. Physics	2019 - 2020
M19EPH02	ELECTRONIC APPLIANCES	
Credit: 4		

UNIT I :

Electronic Componenets Components – Resistors – Condensers – resistance Value – Capacitor Value – Diodes – transistors – IC's.

UNIT II :

Electrical Appliances Basic of UPS – Stabilizers – Voltage regulators – Iron Box – Heaters – Electrical Over – Refrigerators – Air Conditioners – Freezers – Washing Machines.

UNIT III :

Electronic Appliances Basics of Radio – TV – CD Players – LCD Projectors – Digital Camera – Scanners – Video Conferencing.

UNIT IV :

Computers Block diagram of a Computer – Input Device – Memory Device – Control Unit – Arithmetic logic unit – Output device – Microprocessor – RAM – ROM.

UNIT V :

Communication Electronics Basics of Telephones – Mobile Phones – Wireless Phones – Antenna – Internet – Satellites.

TEXT BOOKS:

S.No	Title of the Book	Author	Publisher	Year of Publication
1	Electronics & Mathematical Data Book	S. S. Kamble	Allied Publishers Ltd	1997
2	Electronic Instrumentation and Measurement Technique	William David Cooper	Prentice Hall	2007

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