VIVEKANANDHA

COLLEGE OF ARTS AND SCIENCES FOR WOMEN

(Autonomous)

ELAYAMPALAYAM, TIRUCHENGODE (Tk.), NAMAKKAL (Dt.)

An ISO 9001: 2015 Certified Institution

(Affiliated to Periyar University, Approved by AICTE & Re-accredited with 'A' Grade by NAAC) (Recognized under section 2(f) and 12(B) Under Act 1956)

AUTONOMOUS

PG AND RESEARCH

DEPARTMENT OF PHYSICS

M.Sc., Physics

OBE Syllabus

(2022-2023)

(Revised)

VIVEKANANDHA EDUCATIONAL INSTITUTIONS

Angammal Educational Trust

Elayampalayam, Tiruchengode (Tk.), Namakkal (DT).

About the College

Vivekananda College of Arts and Sciences for Women (Autonomous) was established and hailed into Women's Educational Service in the Year 1995. Angammal Educational Trust Chaired by the great Educationalist 'VidhyaRathna Prof.Dr. M. KARUNANITHI, B.Pharm. M.S., Ph.D., D.Litt. sponsors this college and other institutions under the name of the great Saint Vivekanandha. Our institutions are situated on either side of Tiruchengode Namakkal Main Road at Elayampalayam, 6 kms away from Tiruchengode. This is biggest women's college in India with more than 7500 girl students and more than 18 departments. The strength of the college was just 65 at the time of its establishment. With the dedication, work, sacrifice and long vision of the chairman, this institution has grown into a Himalaya stage. As a result of which UGC, New Delhi, awarded 2f and 12b, extended Autonomous status for second cycle. The National Assessment and Accreditation Council reaccredited with grade 'A' for its successful performance.

As an Autonomous Institution, academic professionals of the college fram Curriculum and Syllabi in consultation with all its stakeholders to cater the needs the young women to fulfill the women empowerment and present Industrial needs the local benefits. The students are empowering with confidence and required sk to face the society.

Quality Policy

To provide professional training by establishing a high level center of learning that provides quality education at par with the international standards and Provide excellence education with well equipped infrastructure to all the rural women.

Our Vision

To be an academic institution exclusively for women, in dynamic equilibrium with the social and economic environment, strive continuously for excellence in education, research and technological service to the nation.

Our Mission

Themission of our institution is to discover, teach and apply knowledge for the intellectual, cultural, ethical, social and economic growth of women students.

M.Sc. (Physics)

SCOPE OF THE COURSE

M.Sc. (Physics), the recent developments in Physical sciences, has been included in the enriched syllabus to meet out the present day needs of academic and research, institutions and industries. The program expects serious commitment of the student to take-up challenging students' schedules and assignments. The course involves a blend of theoretical education and practical training which run concurrently for a period of two years and equips a student with knowledge, ability, skills and other qualities required for a professional accountant.

The uniqueness of the program is its content and topic coverage, the teaching methodology and the faculty. The syllabus has been designed at a level equal to that of professional courses. The teaching methodologies include classroom lectures, industrial visits, orientation, internship, case study and research work. Focus is also on developing soft skills of the students. For Core subjects, Outsource Guest Lectures by Industrialists and Professional Men will be arranged to enable the students to get wider exposure.

SALIENT FEATURES

- ✓ Course is specially designed for a higher level Career Placement.
- ✓ Special Guest lecturers from Industrialists will be arranged.
- ✓ Exclusively caters to students interested in pursuing higher studies.
- ✓ Special Industry Orientations and Training are parts of the Degree Course.
- ✓ Project work is included in the syllabus to enhance conceptual, analytical & deductive skills.

OBJECTIVES OF THE COURSE

- ✓ The new syllabus throws light on the recent and emerging areas of Physics
- ✓ Enable the students understand Physics and make them more relevant to the society.
- ✓ Develop the analytical ability in students so that they are become objective solving problems.
- ✓ Help the students learn practical skills in a better way.
- ✓ Inculcate research aptitude in students.
- ✓ Enable the students to go to higher levels of learning Physics.
- ✓ Improve the employability of the students.
- ✓ To inspire the students to apply their knowledge gained for the development of society in general.

ELIGIBILITY FORADMISSION

Candidates seeking admission to the first year Degree course (M.Sc Physics) shall be required to have passed an Under Graduate degree, i.e. B.Sc (Physics or Applied Sciences) of the Periyar University or an examination of som other University accepted by the syndicate as equivalent there to shall b permitted to be eligible.

DURATION OF THE COURSE

- ✓ The course shall extend over a period of two academic years consisting of four semesters. Each academic year will be divided into two semesters. The First semester will consist of the period from July to November and the Second semester from December to March.
- ✓ The subjects of the study shall be in accordance with the syllabus prescribed from time to time by the Board of Studies of Vivekanandha College of Arts and Sciences for Women with the approval of Periyar University.
- ✓ Each subject will have five hours of lecture per week apart from practical training at the end of each semester.

CONTINUOUS INTERNAL ASSESSMENT

The performance of the students will be assessed continuously and the Internal Assessment Marks will be asunder:

1. Average of two Tests - 10 Marks
2. Seminar - 5 Marks
3. Assignment - 5 Marks
4. Attendance - 5 Marks

…….

Total = 25 Marks

The distribution of attendance marks is given as follows,

76-80 % - 1 Mark

81-85 % - 2 Marks

86-90 % - 3 Marks

91-95 % - 4 Marks

96-100 % - 5 Marks

QUESTION PAPER PATTERN:

Question Paper Pattern for the Examinations

Time: 3 Hours, Maximum Marks: 75

Part - A Answer all the questions (Objective Type) (20 x 1 = 20 Marks)
Part - B Answer all the following questions (Either or Type) (5 x 5 = 25 Marks)
Part – C Answer any three questions (3 x 10 = 30 Marks)

PASSING MINIMUM

In the University Examinations, the passing minimum shall be 40 % out of 75 Marks for theory (38 marks) and 40% out of 60 marks for practical (24 Marks).

ELIGIBILITY FOR EXAMINATION

A candidate will be permitted to appear for the University Examination only on earning 75 % of attendance and only when her conduct has been satisfactory. It shall be open to grant exemption to a candidate for valid reasons subject to conditions prescribed.

CLASSIFICATION OF SUCCESSFULCANDIDATES

Successful candidates passing the examination of Core Courses (main and allied subjects) and securing marks

a) 75 % and above shall be declared to have passed the examination in first class with Distinction provided they pass all the examinations prescribed for the course at first appearance itself.

b) 60% and above but below 75 % shall be declared to have passed the examinations in first class without Distinction.

c) 50%and above but below 60% shall be declared to have passed the examinations in second class.

d) All the remaining successful candidates shall be declared to have passed the examinations in third class.

e) Candidates who pass all the examinations prescribed for the course at the first appearance itself and within a period of three consecutive academic years from the year of admission only will be eligible for University rank.

COMMENCEMENT OF THESE REGULATIONS

These regulations shall take effect from the academic year 2022 - 2023 (i.e for the students who are to be admitted to the first year of the course during the academic year 2022 – 2023 and thereafter.

SCHEME OF CURRICULUM – M.Sc., PHYSICS

(For the candidates admitted during the academic year 2022 – 2023 onwards)

SEMESTER - I								
Subject Code	**Course**	**Subject Title**	**Hrs**	**Credit**	**Exam**	**Int. mark**	**Ext. mar**	**Total Mark**
22P1PH01	Core – I	Classical and Statistical Mechanics	6	4	3	25	75	100
22P1PH02	Core – II	Mathematical Physics	6	4	3	25	75	100
22P1PH03	Core – III	Advanced Electronics	6	4	3	25	75	100
22P1PHE01	Elective	**Elective – I:** Nano science	4	4	3	25	75	100
22P1PHP01	Practical	**Practical – I:** Advanced Electronics Experiments	8	4	4	40	60	100
Total			**30**	**20**	**16**	**140**	**360**	**500**
SEMESTER - II								
22P2PH04	Core - IV	Electromagnetic Theory and Plasma Physics	6	5	3	25	75	100
22P2PH05	Core - V	Quantum Mechanics - I	6	5	3	25	75	100
22P2PH06	Core - VI	Spectroscopy: Principles and Techniques	6	4	3	25	75	100
22P2PHE07	Elective	**Elective – II:** Medical Physics	4	4	3	25	75	100
22P2PHP02	Practical - II	**Practical - II:** Advanced Physics Experiments - I	8	4	4	40	60	100
22P2PHIN	Internship	Compulsory Internship Programme (15 days) Relative to Curriculum	-	-	-	-	-	-
Total			**30**	**22**	**16**	**140**	**360**	**500**

SEMESTER - III								
22P3PH07	Core - VII	Condensed Matter Physics	6	4	3	25	75	100
22P3PH08	Core - VIII	Quantum Mechanics - II	6	4	3	25	75	100
22P3PH09	Core - IX	Microprocessor and Microcontroller	4	4	3	25	75	100
21P3CHED01	EDC	Applied Polymer Chemistry	4	4	3	25	75	100
22P3PHP03	Core Practical - III	**Practical - III:** Microprocessor Experiments	8	4	4	40	60	100
22P3HR01	Common subject	Human Rights	2	2	3	25	75	100
Total			**30**	**22**	**19**	**165**	**435**	**600**
SEMESTER - IV								
22P4PH10	Core – X	Nuclear and Particle Physics	5	5	3	25	75	100
22P4PH11	Core - XI	Communication Electronics	5	5	3	25	75	100
22P4PHE03	Elective - III	**Elective – III:** Thin Film Technology	4	4	3	25	75	100
22P4PHP04	Core Practical	**Practical - IV:** Advanced Physics Experiments - II	8	4	4	40	60	100
22P4PHPR01	Core - XI	Project Work	8	8	3	50	150	200
Total			**30**	**26**	**16**	**165**	**435**	**600**
Total (I & II Years)			**120**	**90**	**67**	**610**	**1590**	**2200**

Distribution of Duration and Credit under Different Papers

Part	Paper	Hours / Week	Weeks/ Semester	Hour/ Paper	No. of Papers	Credit /Paper	Total Hours	Total Credit
I	Core Paper	6	15	90	11	4/5	990	48
I	Core Practical	4	15	60	4	4	240	16
II	Elective	4	15	60	3	4	200	12
II	EDC	4	15	60	1	4	60	4
-	Human Rights	2	15	15	1	1	15	2
-	Project Work	1	15	15	1	8	15	8
TOTAL CREDIT								**90**

LIST OF CORE PAPRES

S.No	Code	Course Title
1.	22P1PH01	Classical and Statistical Mechanics
2.	22P1PH02	Mathematical Physics
3.	22P1PH03	Advanced Electronics
4.	22P2PH04	Electromagnetic Theory and Plasma Physics
5.	22P2PH05	Quantum mechanics – I
6.	22P2PH06	Spectroscopy: Principles and Techniques
7.	22P3PH07	Condensed Matter Physics
8.	22P3PH08	Quantum Mechanics – II
9.	22P3PH09	Microprocessor and Microcontroller
10.	22P4PH10	Nuclear and Particle Physics
11.	2242PH11	Communication Electronics

LIST OF ELECTIVES

S.No	Code	Course Title
1	20P1PHE01	Nano Science
2	20P2PHE02	Crystal Physics
3	20P4PHE03	Thin Film Technology
4	20P2PHE04	Bio Physics
5	20P2PHE05	Non Linear Dynamics
6	20P4PHE06	Sensors and Actuators
7	20P2PHE07	Medical Physics

LIST OF EXTRA DISCIPLINARY COURSE

S.No	Code	Course Title
1.	20P3PHED1	Solar Energy
2.	20P3PHED2	Electronics Appliances

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**							
Programme	M.Sc.,	Programme Code	PPH		Regulations	2022-2023		
Department	Physics		Semester			1		
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	TOTAL
22P1PH01	**CLASSICAL AND STATISTICAL MECHANICS**	6	0	0	4	25	75	100
COURSE OBJECTIVES	1. The main goal of the course is to introduce students to classical mechanics and its applications in physics and studied rigorously using advanced mathematical techniques.							
POs	**PROGRAMME OUTCOME**							
PO 1	Capable of demonstrating the basic concept sand comprehensive knowledge from undergraduate programme of study.							
PO 2	Ability to express thoughts and ideas effectively Communicate with others using appropriate media and interpret the idea in clear and concise manner.							
PO 3	To identify the relevant assumptions to formulate the arguments by following scientific approach to knowledge development.							
PO 4	Capacity to solve different kinds of non-familiar problems and apply to real life situations.							
PO 5	Ability to evaluate the reliability and relevance of evidence, analyze and synthesize data from a variety of sources then draw valid conclusions and support them with evidence and examples, and addressing opposing view points.							
PO 6	To define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, predict cause-and-effect relationships and ability to plan, execute and report the results of an experiment.							
PO 7	Ability to work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group and act together as a group.							
PO 8	Ability to analyze, interpret and draw conclusions from quantitative/qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective							
PO 9	Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.							
PO 10	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources and use appropriates of they are analysis of data.							
PO 11	Ability to work independently, identifies appropriate resources required for a project, and manages a project through to completion.							
PO 12	Capability to effectively engage in a multicultural society and interact respectfully with diverse groups.							
PO 13	Capable of demonstrating the ability to identify ethical issues related to ones work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data.							
PO 14	Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building at who can help achieve the vision.							
PO 15	Ability to acquire knowledge and skills, including how to learn, that are necessary for participating in learning activities throughout life.							
COs	**COURSE OUTCOME**							
CO 1	To understand the fundamental principles of Lagrange formulation. Apply linear harmonic oscillator in Lagrange formulation.							

CO 2	To acquire knowledge of Hamiltons canonical equations. Understand the harmonic oscillator problem.
CO 3	Understand the angular momentum of a rigid body.
CO 4	Understand the ideas liouvlies theorem. Synthesis phase space.
CO 5	To understand the equations Fermi Dirac statistics .Apply ideal Bose Einstein gas blackbody radiation.
Pre-requisites	To Acquire idea about statistics.

KNOWLEDGE LEVELS

1.Remembering, 2.Understanding, 3.Applying, 4.Analyzing, 5.Evaluating, 6.Synthesizing

CO / PO / KL Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	KLs	POs	KLs
CO 1	2	PO 1	1
		PO 2	2
		PO 3	2
CO 2	1	PO 4	3
		PO 5	5
		PO 6	1
CO 3	2	PO 7	6
		PO 8	4
		PO 9	5
CO 4	6	PO10	1
		PO11	2
		PO 12	2
CO 5	3	PO 13	3
		PO14	3
		PO 15	6

CO / PO Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	Programme Outcome (POs)														
	PO 1	PO2	PO3	PO4	PO 5	PO6	PO 7	PO8	PO9	PO1 0	PO 1 1	PO 1 2	PO 1 3	PO 1 4	PO15
CO1	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO2	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO3	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO4	1	1	1	1	2	1	1	1	2	1	1	1	1	1	3
CO5	1	2	2	3	1	1	1	2	1	1	2	2	3	3	1

Course assessment methods

Direct

1. Continuous Assessment Test I, II &Model
2. Assignment
1. End Semester Examinations

Content of the Syllabus			
Unit-I	**FUNDAMENTAL PRINCIPLES AND LAGRANGIAN FORMULATION**	**Periods**	**12**
	Mechanics of a system of particles – Conservation laws - Constraints, Generalized coordinates, Cyclic Coordinates – D'Alembert's principle – Lagrange's equation of motion from D'Alembert's principle - Procedure for formation of Lagrange's equation - Application of Lagrange's formulation: Linear Harmonic oscillator - Simple pendulum – Atwood's machine – Particle moving on the surface of earth - Hamiltons principle - Derivation of Lagrange's equation of motion from Hamilton's principle.		
Unit-II	**HAMILTON'S FORMULATION OF MECHANICS AND SMALL OSCILLATIONS**	**Periods**	**12**
	Hamilton's Canonical equations of motion - Hamilton's equations from variational principle – Principle of least action – Canonical transformations – Physical Significance of H – Deduction of Hamilton's equation from modified Hamilton's principle - Principle of least action – - Canonical transformations - Poisson brackets - Hamilton - Jacobi Theory - Harmonic oscillator problem using Hamiltonian Jacobi method. **Small Oscillation:** Equilibrium – Normal Coordinates – Normal modes.		
Unit-III	**DYNAMICS OF A RIGID BODY AND SPECIAL THEORY OF RELATIVITY**	**Periods**	**12**
	Generalized co-ordinates for Rigid Body Motion – Body and Space reference system – Euler's theorem Euler Angles – Components of Angular Velocity - Angular Momentum of a rigid body: Moments and Products of Inertia – Moment of inertia of a rigid body - Eulers equation of motion - Relativistic Approach Lorentz transformation - Motion of a symmetry top – action and angle Variables - Relativistic Lagrangian and Hamiltonian Formulation.		
Unit-IV	**CLASSICAL STATISTICS**	**Periods**	**12**
	Phase Space – Ensemble - Definition of Micro Canonical - Canonical and Grand Canonical ensembles - Liouvilles theorem - Microstates and Macrostates - Strling's formula, Entropy in statistical mechanics - Partition function - Doppler broadening of spectral lines - Principle of equi partition of energy – connection between Partition function and thermodynamically quantities - Maxwell - Boltzman Statistics.		
Unit-V	**QUANTUM STATISTICS**	**Periods**	**12**
	Identical particles and Symmetry requirements - Bose - Einstein Statistics and Fermi - Dirac statistics - Ideal Bose Einstein gas and its application: Black body radiation and Planck Radiation Law - Gas degeneracy – Bose - Einstein Condensation - Random walk and Brownian motion - Ideal Fermi Dirac gas: Electron gas - Thermionic emission - Paulis theory of Paramagnetism.		
	Total Periods		**60**

Indirect	
1. Course End Delivery	
TEXT BOOKS	
1	Classical Mechanics, Gupta, Kumar and Sharma, Pragati Prakashnan, Meerut, (2011).
2	Classical Mechanics, J.C.Upadyaya, Himalaya Publishing House, (2014).
3	Statistical Mechanics, Satya Prakash, (2019).
4	Statistical Mechanics, Gupta and Kumar, Pragati Prakashnan, Meerut, (2005).
5	Classical Mechanics G.Aruldhas.
REFERENCES	
1	Classical Mechanics, H.Goldstein, Narosa Publishing House, NewDelhi, (2005).
2	Classical Mechanics, C.R.Mondal, Prentice-HallofIndia, NewDelhi, (2008).
E-REFERENCES	
1	https://www.britannica.com/science/classical-mechanics
2	https://phys.libretexts.org/Bookshelves/Classical_Mechanics/Variational Principles in Classical Mechanics (Cline)/15%3A Advanced Hamiltonian Mechanics /15.02%3A Poisson bracket Representation of Hamiltonian Mechanics.
3	https://www.chegg.com/homework-help/definitions/classical-Mechanics-II.
4	https: //nptel.ac.in / courses / 115105098.
5	https: //nptel.ac.in / courses / 115106123.

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**							
Programme	M.Sc.,	Programme Code	PPH		Regulations	2022 - 2023		
Department	Physics		Semester			I		
Course Code	Course Name	Periods Per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
22P1PH02	**MATHEMATICAL PHYSICS**	5	1	0	4	25	75	100
COURSE OBJECTIVES	1. This course covers a broad spectrum of mathematical techniques essential to the solution of advanced problems in physics. 2. The main objective of this course is to provide the student with the repertoire of mathematical methods that are essential to the solution of advanced problems encountered in the fields of applied physics.							

COs	**COURSE OUTCOME**
CO 1	Understand the complex variables, Understand the characteristic equation of matrix and evaluate Hamiltonian theorem.
CO 2	Ability to solve the problem by computational method and acquire knowledge about probability.
CO 3	To acquire knowledge of Fourier and Laplace transform. Understand the Fourier integrals and Apply Fourier transformation in interferometer.
CO 4	Understand the relation between beta and gamma function and evaluate the gamma function To find application by using special function.
CO 5	Ability to solve PDE problem, To acquire knowledge of vector tensor and matrices. To acquire the knowledge of group theory.
Pre-requisites	To gain knowledge for solving problem.

Knowledge Levels

1.Remembering, 2.Understanding, 3.Applying, 4.Analyzing, 5.Evaluating, 6.Synthesizing

CO / PO / KL Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1- weak)

COs	KLs	POs	KLs
CO 1	2	PO 1	1
		PO 2	2
		PO 3	2
CO 2	1	PO 4	3
		PO 5	5
		PO 6	1
		PO 7	6

CO 3	1	PO 8	4
		PO 9	5
CO 4	5	PO 10	1
		PO 11	2
		PO 12	2
CO 5	5	PO 13	3
		PO 14	3
		PO 15	6

CO / PO Mapping
(3/2/1 indicates the strength of correlation, 3-strong, 2- medium, 1-weak)

COs	Programme Outcome (POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO2	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO3	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO4	1	1	1	1	3	1	2	2	3	1	1	1	1	1	2
CO5	1	1	1	1	3	1	2	2	3	1	1	1	1	1	2

Course Assessment Methods

Direct

1.Continuous Assessment Test I, II & Model
2. Assignment

3.End Semester Examinations

Indirect

1. Course End Delivery

CONTENT OF THE SYLLABUS

Unit - I	**COMPLEX AND VECTOR ANALYSIS & MATRICES**	**Periods**	**12**
	Complex Analysis: Cauchy - Riemann condition, Differential equation - Cauchy integral theorem - Cauchy integral formulas - Taylors Series - Laurent's Series - Residue theorem - Evaluation of definite integrals - Contour integration. **Vector analysis:** Stokes theorem, Gauss theorem - Green's Theorem - Linear algebra - Linear vector spaces. Characteristic equation of a matrix, Eigen values and Eigen vectors, Cayley - Hamilton theorem.		
	PROBABILITY AND COMPUTATIONAL TECHNIQUE	**Periods**	**12**

Unit - II	**Probalibility:** random variables, Binomial, Poisson and Normal distributions. Central limit theorem. Elements of computational Techniques: Root of functions, Newton's Interpolation Polynomials Extrapolation, Integration by Trapezoidal and Simpson's 1/3 and 3/8 rules and Solution of first order differential equation using Runge - Kutta method. Finite difference methods.		
Unit -III	**FOURIER AND LAPLACE TRANSFORMS**	**Periods**	**12**
	Fourier series: Dirichelt's condition – determination of coefficient – function having arbitrary period – Fourier series for square wave and half wave. **Fourier Transform:** Properties of Fourier transform - Fourier transform of derivative – Fourier sine and cosine transform of derivative –Application of Fourier Transformation in Interferometer. **Laplace Transform:** Properties of Laplace transform – Method of finding Inverse Laplace transform - Properties of inverse Laplace transform - Solving equations for LCR circuit.		
Unit-IV	**SPECIAL FUNCTIONS AND DIFFERENTIAL EQUATIONS**	**Periods**	**12**
	Special Function: Beta function - property of beta function - Evaluation of beta function - Evaluation of gamma function - Relation between Beta and Gamma functions. **Differential Equations:** Linear ordinary differential equations of first &second order - Solution for Bessel, Legendre, Lagure and Hermite differential equations - Properties - Generating functions, Rodrigues formula, Orthogonal properties, Recurrence relation.		
Unit - V	**GROUP THEORY, APPLICATION OF PDE AND TENSOR**	**Periods**	**12**
	Group Theory: Basic Definition - Multiplication Table - Sub groups - Cosets and Classes, - Character Table - C2Vas examples, SU(2). **Application of PDE:** Laplace, wave and heat equations in two and three dimensions. **Tensor:** Contravariant, Covariant and mixed tensors, Rank of tensor, Kronecker delta, Symmetric and Anti symmetric tensors.		
	Total Periods		**60**

TEXT BOOKS	
1	Mathematical Physics, B.D. Gupta, Vikas Publishing House, (2004).
2	Mathematical Physics, Satyaprakash, Sultan Chand and Sons, (2004).
3	Mathematical Physics, HK Das, S.Chand Co, New Delhi (2022).

REFERENCES	
1	Mathematical Physics, P.K. Chattopadhyay, Wiley Eastern India, (1990).

2	Chemical applications of group theory, F.A. Cotton, Wiley Eastern India, (2001).
3	Elements of group theory for physicist, A.W Joshi, New age international Publishers, (2002).
4	Mathematical Physics, MP Kakani, S.Chand Co,.
E-REFERENCES	
1	1.https://www.khanacademy.org/math/differential-equations/laplace-transform.
2	2. https://www.khanacademy.org/math/linear-algebra#vectors-and-spaces.
3	3.https://www.khanacademy.org/math/linear-algebra#matrix-transformations.
4	https://nptel.ac.in/courses/115106086.
5	https://nptrel.ac.in/courses/ 111106148.

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**				
Programme	M.Sc.,	Programme Code	PPH	Regulations	2022-2023
Department	Physics		Semester		I

Course Code	Course Name	Periods per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
22P1PH03	**ADVANCED ELECTRONICS**	6	0	0	4	25	75	100

COURSE OBJECTIVES	1. The aim of the course is to introduce the students to the advanced concepts of electronics. 2. Acquire basic knowledge of advanced electronics such as Operational Amplifier, Memory and Optoelectronic Devices etc.
POs	**PROGRAMME OUTCOME**
PO 1	Capable of demonstrating the basic concept sand comprehensive knowledge from undergraduate Programme of study.
PO 2	Ability to express thoughts and ideas effectively Communicate with others using appropriate media and interpret the idea in clear and concise manner.
PO 3	To identify the relevant assumptions to formulate the arguments by following scientific approach to knowledge development.
PO 4	Capacity to solve different kinds of non-familiar problems and apply to real life Situations.
PO 5	Ability to evaluate the reliability and relevance of evidence, analyze and synthesize data from a variety of sources then draw valid conclusions and support them with evidence and examples, and addressing opposing Viewpoints.
PO 6	To define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, predict cause-and-effect Relationships and ability to plan execute and report the results of an experiment.
PO 7	Ability to work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group and act together as a group.
PO 8	Ability to analyze, interpret and draw conclusions from quantitative /qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.
PO 9	Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.
PO 10	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources and use appropriate software for analysis of data.
PO 11	Ability to work independently, identifies appropriate resources required for a project, and manages a project through to completion.
PO 12	Capability to effectively engage in a multicultural society and interact respectfully with diverse groups.
PO 13	Capable of demonstrating the ability to identify ethical issues related to ones work, avoid unethical behavior such as fabrication, falsification or Misrepresentation of data.

PO 14	Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision.
PO 15	Ability to acquire knowledge and skills, including how to learn, that are necessary for participating in learning activities throughout life.

COs	**COURSE OUTCOME**
CO 1	To get knowledge about the basics information of ideal Op-amp.
CO 2	Apply the sample and hold circuit in simultaneous equations and differential Equations.
CO 3	Understand the filters, basic DAC and ADC techniques.
CO 4	Synthesis the basic monolithic IC.
CO 5	To acquire Knowledge the memory devices and apply in optoelectronic devices.
Pre-requisites	To Acquire idea about Advanced Electronics.

Knowledge Levels

1.Remembering, 2.Understanding, 3.Applying, 4.Analyzing, 5.Evaluating, 6.Synthesizing

CO / PO / KL Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	KLs	POs	KLs
CO 1	1	PO 1	1
		PO 2	2
		PO 3	2
CO 2	3	PO 4	3
		PO 5	5
		PO 6	1
CO 3	2	PO 7	6
		PO 8	4
		PO 9	5
CO 4	6	PO 10	1
		PO 11	2
		PO 12	2
CO 5	1	PO 13	3
		PO 14	3
		PO 15	6

CO / PO Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	**Programme Outcome (POs)**														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO2	1	2	2	3	1	1	1	2	1	1	2	2	3	3	1
CO3	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO4	1	1	1	1	2	1	1	1	2	1	1	1	1	1	3
CO5	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1

Course Assessment Methods
Direct

1. Continuous Assessment Test - I, II & Model 2. Assignment 3. End Semester Examinations
Indirect
1. Course End Delivery

CONTENT OF THE SYLLABUS			
Unit - I	**OPERATIONAL AMPLIFIER**	**Periods**	**12**
	Operational amplifiers: Basic information - Ideal op-amp - Open loop operation - Feedback in ideal op-amp - Inverting and Non - inverting amplifier, Voltage Follower, Differential amplifier, CMRR. DC Characteristics - Input bias current, Input offset current, Input offset voltage, Total output offset voltage, Thermal drift. AC Characteristics - Frequency Response, Stability of an Op - amp, Frequency Compensation, Slew rate.		
Unit - II	**ANALOG COMPUTATION AND WAVEFORM GENERATORS**	**Periods**	**12**
	Basic Op-amp Applications - Logarithmic amplifiers, Antilogarithmic amplifiers. Adder – subtractor- Analog multiplier- Analog divider – Differentiator – Integrator – Squarer – comparator - Analog Computation - Solving Simultaneous equation and Differential equation - Sine wave oscillator - RC Phase shift oscillator - Wein - Bridge oscillator, method - Harmonic oscillator problem using Hamiltonian Comparator, Schmitt trigger, Astable and Monostable multivibrators - Triangular wave generator.		
Unit - III	**FILTERS AND DATA CONVERTERS**	**Periods**	**12**
	FILTERS: RC Active filters - First order low pass filter, Second order active filter, Higher order low pass filter, High pass active filter, Band pass filters and Band reject filters. **DATA CONVERTERS:** Basic DAC techniques: Weighted resistor DAC, R-2R Ladder DAC. Basic ADC techniques - Successive approximation A/D convertor, Dual - Slope ADC, DAC/ADC Specifications.		
Unit - IV	**IC 555 TIMER AND APPLICATIONS**	**Periods**	**12**
	IC 555 Timer – Internal architecture – Monostable– Multivibrator - – Linear ramp generator – Frequency divider – Bistable multivibrator - Astable Multivibrator – Applications in astable mode–phase locked loops – Monolithic phase locked loops.		
Unit - V	**MEMORY AND OPTOELECTRONIC DEVICES**	**Periods**	**12**
	Architecture of ROM - PROM, EPROM, EEPROM, EAROM. RAM – Static RAM - Dynamic RAM and Integrated RAM – Compact Disk. Solar cells - LED – Photodiode – Pin Diode – LCD - LDR.		
	Total Periods		**60**

TEXT BOOKS	
1	Handbook of Electronics, Gupta and Kumar, Pragati Prakashnan, Meerut, (2003).
2	Linear Integrated Circuits, D. Roy choudry, New Age Publications, (2015).
3	VK Metha, Sedha.
REFERENCES	
1	Electronic Measurement and Instrumentation, William Cooper, TMG Hill,(2001).
2	Operational Amplifier, Robert F, Pearson Hill, (2015).
E-REFERENCES	
1	www.khanacademy.org/science/physics/electronics/operational amplifier.
2	www.khanacademy.org/science/physics/electronics/memory and optoelectronic devices.

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**							
Programme	M.Sc.,	Programme Code	PPH		Regulations	2022-2023		
Department	Physics		Semester			I		
Course Code	Course Name		Periods per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
22P1PHE01	**ELECTIVE:** **NANO SCIENCE**		4	0	0	4	25	75	100
COURSE OBJECTIVES	1. To provide the basic skills required to understand, develop, and design Nanomaterials. 2. To enhance the research interest in Nanotechnology							
POs	**PROGRAMME OUTCOME**							
PO 1	Capable of demonstrating the basic concept sand comprehensive knowledge from undergraduate programme of study.							
PO 2	Ability to express thoughts and ideas effectively Communicate with others using appropriate media and interpret the idea in clear and concise manner.							
PO 3	To identify the relevant assumptions to formulate the arguments by following scientific approach to knowledge development.							
PO 4	Capacity to solve different kinds of non-familiar problems and apply to real life situations.							
PO 5	Abilitytoevaluatethereliabilityandrelevanceofevidence,analyzeandsynthesizedat a from a variety of sources then draw valid conclusions and support them with evidence.							
PO 6	To define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw Conclusions from data, predict a use-and-effect relationships and ability to plan, execute.							
PO 7	Ability to work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group and act together as a group.							
PO 8	Ability to analyze, interpret and draw conclusions from quantitative/qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.							
PO 9	Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.							
PO 10	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources and use appropriate software for analysis of data.							
PO 11	Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.							
PO 12	Capability to effectively engage in a multicultural society and interact respectfully with diverse groups.							
PO 13	Capable of demonstrating the ability to identify ethical issues related to ones work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data.							
PO 14	Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision.							
PO 15	Ability to acquire knowledge and skills, including how to learn, that are necessary for participating in learning activities throughout life.							

COs	COURSE OUTCOME
CO 1	To acquire more knowledge about mechanical, electrical, optical properties of nano particles.
CO 2	Analyze the nano fabrication and nano patterning
CO 3	Understand characterization techniques of nano particles Analyze the SEM and TEM equipments.
CO 4	Acquire knowledge about working principle of photo luminescence spectroscopy. Understand the working principle of XRD and UV.
CO 5	Apply carbon nano tubes for electronics applications.
Pre-requisites	To Acquire idea about Nano Science.

Knowledge Levels

1.Remembering, 2.Understanding, 3.Applying, 4.Analyzing, 5.Evaluating, 6.Synthesizing

CO / PO / KL Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	KLs	POs	KLs
CO 1	1	PO 1	1
		PO 2	2
		PO 3	2
CO 2	4	PO 4	3
		PO 5	5
		PO 6	1
CO 3	2	PO 7	6
		PO 8	4
		PO 9	5
CO 4	2	PO 10	1
		PO 11	2
		PO 12	2
CO 5	3	PO 13	3
		PO 14	3
		PO 15	6

CO / PO Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	**Programme Outcome (POs)**														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO2	1	1	1	2	2	1	1	3	2	1	1	1	2	2	1
CO3	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO4	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO5	1	2	2	3	1	1	1	2	1	1	2	2	3	3	1

Course Assessment Methods

Direct

1. Continuous Assessment Test - I, II & Model
2. Assignment
3. End Semester Examinations

Indirect

1. Course End Delivery

CONTENT OF THE SYLLABUS

Unit - I	**CONCEPT OF NANOSCIENCE**	**Periods**	**12**
	Introduction of nanoscale science: surface to volume ratio Quantum Size effect - Particle Size - Particles shape; Nanostructures: Zero, One, Two and Three dimensional structure Physical properties of nanoparticles: Particle density; Melting point ; Surface tension; wettability and Composite structure - Surface characteristics of nanoparticles - Specific surface area and pore - Mechanical properties - Crystalline properties - Optical properties - Electrical properties - Magnetic properties.		
Unit - II	**NANOFABRICATION**	**Periods**	**8**
	Top down and bottom up ideas – Top down approach Ball Milling method – Sputtering Technique – Sol – gel – Hydrothermal – CVD method- and electron beam Lithography - Bottom up approach - PVD method - thermal Evaporation – Microwave techniques.		
Unit - III	**CHARACTERIZATION TECHNIQUES**	**Periods**	**11**
	Surface Analysis: Scanning Electron Microscope (SEM); Transmission Electron Microscope (TEM); Atomic Force Microscope (AFM); Working Principle, Instrumentation and applications - Structural analysis: XRD, XRF – Optical analysis: Photoluminescence (PL) Spectroscopy – UV-Vis-NIR Spectroscopy analysis. FTIR - Thermal analysis: Differential Scanning Calorimeter (DSC), Differential Thermal Analyzer (DTA), Thermogravimetric Analysis (TGA). Working Principle, Instrumentation and applications.		
Unit - IV	**NANO SYSTEMS**	**Periods**	**8**
	Quantum Hall effect – Carbon nanostructures: C_{60}; Basics of fullerenes derivatives; CNT: SWNT – MWNT; applications - Graphene nanomaterials: Polymer nanocomposites – nanoermics.		
Unit - V	**APPLICATIONS OF NANOMATERIAL**	**Periods**	**9**
	Optoelectronic properties of molecular materials - Nanotechnology devices: OLEDs, TFT, OTFTs - Biological application of nano particles - Drug delivery system.		
	Total Periods		**48**

TEXT BOOKS	
1	RolandWiesendanger“ScanningProbeMicroscopyandSpectroscopy. Methodsand Applications “Cambidge University Press, (1994).
2	Joel I. Gersten, Frederick W. Smith“The Physics and Chemistry of Materials; John Wiley and Sons, (2001).
3	John C. Vickerman; Surface Analysis (The principal Techniques);John Wiley and Sons, (2003).
REFERENCES	
1	D. Briggs, M.P. Seah; Practical Surface Analysis-Auger and X-ray Photoelectron Spectroscopy, Wiley Inter science, (1990).
2	Sergei N.Magonov, Myung-Hwan Whangbo; Surface Analysis with ST Mand AFM: Experimental and Theoretical Aspects of Image Analysis, VCH Publishers,(1996).
3	Nanoscale materials in chemistry, Kenneth, John Wiley and Sons, (2003).
E-REFERENCES	
1	https://www.google.com/search?q=Basic%20Properties%20of%20Nanoparticle+fil etype%3Adoc
2	https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=5&cad=rja&uact=8&ved=2ahUKEO_cDVnvvcAhXJqY8KHTN2D_YQFjAEegQIBhAC&url=http%3A%2F%2 www.lehigh.edu%2F~inmatpac%2Fsyllabus%2Fs2004mat398.doc&usg=AOvVaw2 0OmcUT7mNM2qfDrdLTkkG

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**							
Programme	M.Sc.,	Programme Code	PPH		Regulations	2022 -2023		
Department	Physics		Semester			II		
Course Code	Course Name		Periods Per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
22P2PH05	**QUANTUM MECHANICS - I**		6	0	0	5	25	75	100
COURSE OBJECTIVES	To acquire knowledge of non-relativistic and relativistic quantum mechanics. Theabilitytounderstandconceptsandtoperformcalculationsofscatteringofparticles.							

POs	**PROGRAMME OUTCOME**
PO 1	Capable of demonstrating the basic concepts and comprehensive knowledge from undergraduate programme of study.
PO 2	Ability to express thoughts and ideas effectively Communicate with others using appropriate media.
PO 3	To identify the relevant assumptions to formulate the arguments by following scientific approach to Knowledge development.
PO 4	Capacity to solve different kinds of non-familiar problems and apply to real life situations.
PO 5	Ability to evaluate the reliability and relevance of evidence, analyse and synthesize data from a variety of sources.
PO 6	To define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data.
PO 7	Ability to work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group.
PO 8	Ability to analyze, interpret and draw conclusions from quantitative /qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.
PO 9	Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.
PO 10	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources.
PO 11	Ability to work independently, identifies appropriate resources required for a project, and manages a project through to completion.
PO 12	Capability to effectively engage in a multicultural society and interact respectfully with diverse groups.
PO 13	Capable of demonstrating the ability to identify ethical issues related to ones work, avoid unethical behavior such as fabrication.
PO 14	Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision.
PO 15	Ability to acquire knowledge and skills, including how to learn, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning.

COs	**COURSE OUTCOME**
CO 1	To get the knowledge about Ehrenfest theorem .Understand the Expectation values of dynamical quantities.
CO 2	Able to understand spin angular momentum. To analyze the eigen values spectrum. Evaluate the properties.
CO 3	Understand the characteristic equation of a matrix. To analyze the Hibert space.
CO 4	Apply the time independent perturbation theory in non degenerate cases. Analyze the fundamental concepts Variation method and its uses.

CO 5	Apply the selection rule for dipole radiation. Evaluate adiabatic and sudden approximation.
Pre-requisites	GET KNOWLEDGE

Knowledge Levels			
1.Remembering, 2.Understanding, 3.Applying, 4.Analyzing, 5.Evaluating, 6.Synthesizing			
CO / PO / KL Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)			
COs	KLs	POs	KLs
CO1	1	PO 1	1
		PO 2	2
		PO 3	2
CO 2	2	PO 4	3
		PO 5	5
		PO 6	1
CO 3	4	PO 7	6
		PO 8	4
		PO 9	5
CO 4	3	PO 10	1
		PO11	2
		PO 12	2
CO 5	5	PO 13	3
		PO 14	3
		PO 15	6

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	**Programme Outcome (POs)**														
	PO 1	PO2	PO 3	PO4	PO5	PO6	PO 7	PO8	PO9	PO1 0	PO 1 1	PO 1 2	PO 1 3	PO 1 4	PO 1 5
CO 1	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO 2	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO 3	1	1	1	2	2	1	1	3	2	1	1	1	2	2	1
CO 4	1	2	2	3	1	1	1	2	1	1	2	2	3	3	1
CO 5	1	1	1	1	3	1	2	2	3	1	1	1	1	1	2

1. Continuous Assessment Test - I, II & Model
2. Assignment
3. End Semester Examinations

Indirect
1. Course End Delivery

CONTENT OF THE SYLLABUS			
Unit-I	**GENERAL FORMALISM OF QUANTUM MECHANICS**	**Periods**	**12**
	Linear vector space – Linear operator – Adjoint and Self adjoint operators – Eigen function and Eigen value – Hermition operator for dynamical variables – Postulates of Quantum Mechanics the Time dependent and Time independent Schroedinger equations – Expectation values of dynamical quantities - Probability of current density – Ehrenfest theorem – Orthonormality – Heisenberg Uncertainty principle – Relations - Simultaneous measurability of observables - Diracs notation – Momentum representation.		
Unit-II	**ANGULAR MOMENTUM**	**Periods**	**12**
	Orbital angular momentum and their properties – Spin angular momentum – Total angular momentum operators – Commutation relation of total angular momentum with components – ladder operators – commutation relation of J_z with J+ and J-, - Eigen values spectrum of J^2, Jx, Jy and Jz – Matrix representation of J^2, Jz, J+ and J-, Addition of angular momenta: Clebsch Gordon Coefficients – selection rules – Properties and its evaluation.		
Unit-III	**MATRIX AND OPERATOR FORMULATION**	**Periods**	**12**
	Eigen values, Eigen vectors: Characteristic equation of a matrix Schrodinger, Heisenberg and Interaction Pictures matrix representation- Unitary transformations associated with translations and rotations. **Diracs Bra and Ket Vectors:** Notation and Dual Space, Hibert Space, Projection Operator, Unitary Operator and Matrix Theory of Harmonic Oscillator.		
Unit-IV	**APPROXIMATION METHODS**	**Periods**	**12**
	First and second orders of Time Dependent Perturbation theory –Non – degenerate case: the First order and the second order –Selection rule – The degenerate case: Removal of Degeneracy-Ground State of Helium Atom - Application to ground state of an harmonic oscillator and Stark Effect in Hydrogen – Spin – Orbit interaction -Variation Method & its application to Hydrogen Molecule – WKB approximation.		
Unit-V	**TIME DEPENDENT PERTURBATION THEORY**	**Periods**	**12**
	Time Dependent Perturbation Theory –First and Second Order Transitions – Transition to Continuum of States: Fermi Golden Rule – Constant and Harmonic Perturbation – Transition Probabilities –Selection Rules for Dipole Radiation-Adiabatic and Sudden Approximation – Charged Particle in an Electromagnetic Field.		
		Total Periods	**60**

TEXT BOOKS		
1	Advanced Quantum Mechanics, SatyaPrakash, Kedar Nath Ram Nath Publications, (2013).	
2	Quantum Mechanics, S.L. Gupta, V. Kumar, H.V. Sharma and R.C.Sharma, Jai Prakash Nath & Co., Meerut (2001-2002).	
3	Quantum Mechanics, Claude, Frank and Bernard, John Wiley Inter science, (2003).	
4	G. Aruldass, Quantum Mechanics, Prentice–Hall of India (PHI) Learning Pvt. Limited, (2019).	
5	Introduction to Quantum Mechanics by Griffiths Cambridge university Press.	
6	Quantum Mechanics: Concepts and Applications by Nouredine Zettili Wiley Second Edition (2009).	
REFERENCES BOOKS		
1	1.A text book of Quantum Mechanics, Mathews and Venkatesan, TMG Hill, (2002).	
2	2.Quantum Mechanics, JaspritSingh, John Wiley Inter science, (2005).	
WEBSITES SOURCES :		
1	http://alan.ece.gatech.edu/ECE6451/Lectures/ECE6451L4 Postulates Of QMAndOperator sVer2.pdf	
2	https://www.youtube.com/watch?v=IKJAJdDEqhM.	
3	https://www.youtube.com/watch?v=Rx9KdNjQmo&list=PL3V8X5qW C1MRmSvEMZUjTU3BisDsi2KqV.	
4	https://nptel.ac.in/courses/122/106/122106034.	

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)

Elayampalayam, Tiruchengode-637 205.

Programme	M.Sc.,	Programme Code	PPH	Regulations	2022-2023
Department	Physics		Semester		II

Course Code	Course Name	Periods per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
22P2PH06	**SPECTROSCOPY – PRINCIPLES AND TECHNIQUES**	6	0	0	4	25	75	100

COURSE OBJECTIVES	1. To know the Basic ideas about different types of spectroscopic theories and to know the principle and functions of spectroscopic instrumentations.
POs	**PROGRAMME OUTCOME**
PO 1	Capable of demonstrating the basic concepts and comprehensive knowledge from undergraduate programme of study.
PO 2	Ability to express thoughts and ideas effectively Communicate with others using appropriate media.
PO 3	To identify the relevant assumptions to formulate the arguments by following scientific approach to knowledge development.
PO 4	Capacity to solve different kinds of non-familiar problems and apply to real life situations
PO 5	Ability to evaluate the reliability and relevance of evidence, analyze and synthesize data from a variety of sources.
PO 6	To define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data.
PO 7	Ability to work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group.
PO 8	Ability to analyze, interpret and draw conclusions from quantitative / qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.
PO 9	Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society
PO 10	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources.
PO 11	Ability to work independently, identifies appropriate resources required for a project, and manages a project through to completion.
PO 12	Capability to effectively engage in a multicultural society and interact respectfully with diverse groups.
PO 13	Capable of demonstrating the ability to identify ethical issues related to ones work, avoid unethical behavior such as fabrication.
PO 14	Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision.
PO 15	Ability to acquire knowledge and skills, including how to learn, that are necessary for participating in learning activities throughout life, through self-paced and self - directed learning.
COs	**COURSE OUTCOME**
CO 1	Understand the techniques of atomic spectroscopy and rotation of molecules and their spectra. Analyze the microwave spectrometer.

CO 2	Analyze IR and Raman spectroscopy. Evaluate the Born Oppenheimer approximation.
CO 3	Understand the instrumentation of UV Photo electron spectroscopy. Analyze the frank Condon principle.
CO 4	Understand the Quantum Mechanical and Classical Description. Apply NMR spectroscopy for determining the content and purity of samples.
CO 5	Understand the principles of ESR spectrometer and analyze the experimental techniques in hyperfine interaction.
Pre-requisites	GET KNOWLEDGE ABOUT SPECTROSCOPY

Knowledge Levels

1.Remembering, 2.Understanding, 3.Applying, 4.Analyzing, 5.Evaluating, 6.Synthesizing

CO / PO / KL Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1- weak)

COs	KLs	POs	KLs
CO 1	2	PO 1	1
		PO 2	2
		PO 3	2
CO 2	4	PO 4	3
		PO 5	5
		PO 6	1
CO 3	2	PO 7	6
		PO 8	4
		PO 9	5
CO 4	3	PO 10	1
		PO 11	2
		PO 12	2
CO 5	4	PO 13	3
		PO 14	3
		PO 15	6

CO / PO Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	**Programme Outcome (POs)**														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO2	1	1	1	2	2	1	1	3	2	1	1	1	2	2	1
CO3	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO4	1	2	2	3	1	1	1	2	1	1	2	2	3	3	1
CO5	1	1	1	2	2	1	1	3	2	1	1	1	2	2	1

Course Assessment Methods

Direct

1. Continuous Assessment Test I, II & Model
2. Assignment
3. End Semester Examinations

Indirect			
1. Course End Delivery			
CONTENT OF THE SYLLABUS			
Unit - I	**ATOMIC SPECTROSCOPY AND MICROWAVE SPECTROSCOPY**	**Periods**	**12**
	Atomic Spectroscopy: Quantum states of electron in atoms – Hydrogenatom spectrum – Basics Principles - Atomic absorption spectrum and Emission spectrum – atomic Absorption Spectrometer - Electron spin – Stern - Gerlach experiment. **Microwave Spectroscopy:** Rotation of molecules and their Spectra, Diatomic molecules, Intensity of line spectra, The effect of isotropic substitution, Non - rigid rotator and their spectra, Polyatomic molecules (Linear and Symmetric top molecules) – Microwave Spectrometer.		
Unit - II	**INFRARED AND RAMAN SPECTROSCOPY**	**Periods**	**12**
	Infrared Spectroscopy: Vibrational energy of diatomic molecules, Simple Harmonic Oscillator, Anharmonic oscillator, Diatomic vibrating rotator, Vibration - Rotation spectrum of carbon monoxide, Influence of rotation on the spectra of polyatomic molecules (Linear and Symmetric top Molecules). **Raman Spectroscopy:** Raman Effect, Quantum Theory of Raman Effect, Pure Rotational Raman Spectra (Linear and Symmetric top molecules), Selection Rules - Degree of depolarization - Rotational Raman Spectrum - Vibrational Raman Spectrum - Structure determination using IR and Raman spectroscopy - Principles and Working of Raman Spectrometer.		
Unit - III	**ELECTRONIC SPECTROSCOPY**	**Periods**	**12**
	Born-Oppenheimer Approximation, Vibrational Coarse and their progressions - Franck- Condon Principle-Dissociation energy and their products - Rotational fine structure of electronic - Vibration Transition - Molecular Orbital theory - Spectrum of molecular hydrogen-Change of shape on excitation - Chemical analysis by electronic spectroscopy-Re-emission of energy by excited molecule-Instrumentation of UV Photoelectron Spectroscopy.		
Unit - IV	**NMR AND NQR SPECTROSCOPY**	**Periods**	**12**
	NMR Spectroscopy: Quantum Mechanical and Classical Description - Bloch Equations - Relaxation Processes - Principle and Working of High Resolution - NMR Spectrometer -Chemical Shift - Applications of NMR Spectroscopy: MRI. **NQR Spectroscopy:** Basic principles - Fundamental requirements - General Principle - Experimental detection of NQR frequencies - Interpretation and Chemical explanation of NQR Spectroscopy.		
Unit - V	**ESR AND MOSSBAUER SPECTROSCOPY**	**Periods**	**12**
	ESR Spectroscopy: Basic Principles, ESR Spectrometer - Reflection Cavity and Microwave bridge - ESR Spectrum - Hyperfine Structure. **Mossbauer Spectroscopy:** Mossbauer Effect, Recoilless emission and absorption - Mossbauer Spectrum: Experimental techniques - Hyperfine interaction - Chemical isomer Shift – Doppler velocity shift – Magnetic hyperfine interaction - electric quadrupole interaction.		
	Total Periods		**60**

TEXT BOOKS	
1	D.N.Sathyanarayana, Vibrational Spectroscopy: Theory and Applications, First Edition, New Age International Publishers Pvt., Ltd., New Delhi (2011).
2	G.Aruldhas, Molecular Structure and Spectroscopy, Second Edition, PHI Learning Pvt., Ltd., New Delhi (2008).
3	C.N.Banwell and E.Mccash, Fundamentals of Molecular Spectroscopy, Fifth Edition, Mcgraw- Hill Education India Pvt., Ltd., New Delhi (2013).
REFERENCES	
1	B.P.Straughan and S.Walkar, Spectroscopy, Volume I-III, Chapman and Hall, New York (1976).
2	Randhawa, Modern Molecular Spectroscopy, Macmillan India Ltd., New Delhi (2003).
E-REFERENCES	
1	www.khanacademy.org/science/physics/spectroscopy/microwave spectroscopy.
2	www.khanacademy.org/science/physics/spectroscopy/IR/raman spectroscopy. -

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**							
Programme	M.Sc.,	Programme Code	PPH		Regulations		2022-2023	
Department	Physics		Semester				II	
Course Code	Course Name		Periods per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
22P2PHE02	**ELECTIVE: BIO PHYSICS**		4	0	0	4	25	75	100
COURSE OBJECTIVES	To learn about the basic biophysics and to know about the principle and working of bio instrumentations and its applications.							
POs	**PROGRAMME OUTCOME**							
PO 1	Capable of demonstrating the basic concepts and comprehensive knowledge from undergraduate Programme of study.							
PO 2	Ability to express thoughts and ideas effectively Communicate with others using appropriate media.							
PO 3	To identify the relevant assumptions to formulate the arguments by following scientific approach to knowledge development.							
PO 4	Capacity to solve different kinds of non-familiar problems and apply to real life situations.							
PO 5	Ability to evaluate the reliability and relevance of evidence, analyse and synthesise data from a variety of sources.							
PO 6	To define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data.							
PO 7	Ability to work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group.							
PO 8	Ability to analyze, interpret and draw conclusions from quantitative/qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.							
PO 9	Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.							
PO 10	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources.							
PO 11	Ability to work independently, identifies appropriate resources required for a project, and manage a project through to completion.							
PO 12	Capability to effectively engage in a multicultural society and interact respectfully with diverse groups.							
PO 13	Capable of demonstrating the ability to identify ethical issues related to ones work, avoid unethical behavior such as fabrication.							
PO 14	Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision.							
PO 15	Ability to acquire knowledge and skills, including how to learn, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning.							

COs	COURSE OUTCOME
CO 1	To acquire the knowledge about strong and weak bonds.
CO 2	Acquire knowledge about radioactivity. Apply GM counter for the detection of ionizing radiation.
CO 3	Acquire the knowledge about Biomolecules and biological energy. Analyze the DNA and RNA conformation. Synthesis the ATP.
CO 4	To acquire the knowledge about the movement of organisms. To understand the Nerve impulse and nervous system.
CO 5	To get the knowledge about Ballistic control in a simplified visual system. To understand the mental processing.
Pre-requisites	GET KNOWLEDGE ABOUT biophysics

Knowledge Levels

1.Remembering, 2.Understanding, 3.Applying, 4.Analyzing, 5.Evaluating, 6.Synthesizing

CO / PO / KL Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	KLs	POs	KLs
CO 1	1	PO 1	1
		PO 2	2
		PO 3	2
CO 2	3	PO 4	3
		PO 5	5
		PO 6	1
CO 3	4	PO 7	6
		PO 8	4
		PO 9	5
CO 4	2	PO 10	1
		PO 11	2
		PO 12	2
CO 5	2	PO 13	3
		PO 14	3
		PO 15	6

CO / PO Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	Programme Outcome (POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO2	1	2	2	3	1	1	1	2	1	1	2	2	3	3	1
CO3	1	1	1	2	2	1	1	3	2	1	1	1	2	2	1
CO4	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO5	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1

Course Assessment Methods

Direct

1. Continuous Assessment Test I, II &Model
2. Assignment
3. End Semester Examinations

Indirect

1. Course End Delivery

CONTENT OF THE SYLLABUS			
Unit - I	**BONDS**	**Periods**	**8**
	Ionization energy electron affinity - chemical bonding - electro negativity -strong bonds secondary bonds. Energies-forces-bonds: Interatomic potentials for strong and weak bonds - bond energies. Rates of reaction: reaction kinetics- water, acids, bases and aqueous reactions. Transport process: Diffusion - viscosity-thermal conduction		
Unit - II	**RADIOACTIVITY**	**Periods**	**8**
	Radiation Biology: Radio activity- Natural radiation (Cosmic rays) - Artificial (or) Induced radioactivity - Radioactive disintegration - Geiger-Muller counter - Crystal counter: Method of detection of disintegration frequency - Biological effects of radiation.		
Unit - III	**BIOLOGICAL STRUCTURE**	**Periods**	**8**
	Bio - molecules and biological energy Biological polymers: Nucleic acids – DNA – RNA – conformation - proteins protein folding. Biological Membranes: Historical background – membrane chemistry and structure - membrane physics. Biological energy: Energy consumption respiration – photosynthesis – ATP synthesis.		
Unit - IV	**NATURE OF ORGANISMS**	**Periods**	**8**
	Movement of organisms Bacterial motion - chemical memory in primitive organisms - muscular movement - human performance, nerve signals and memory Excitable membranes: Diffusion and mobility of Ions - resting potential Nerve signals: Passive response - Nerve impulses (action potentials) - nervous system.		
Unit - V	**INSTRUMENTATION**	**Periods**	**12**
	Control of movement Primary of movement - Ballistic control in a simplified visual system - more sophisticated - mode of control - structure of muscle fibers - central pattern generators - conditioned reflexes – volition - and Free will - consciousness Passive verses active in mental processing.		
	Total Periods		**40**

TEXT BOOKS	
1	Rodyney M.J.Cotterill, Biophysics: An introduction, John Wiley and sons Publications, (2014).
2	Roland Glacer, Biophysics, Springer Publications, (2006).
REFERENCES	
1	P.K.Srivastava, Elementary Biophysics An introduction, Narosa Publishing House, (2005).
2	M.V.Volkenshtein, Biophysics, Mir Publications, Moscow, (2010).
E-REFERENCES	
1	https://www.google.com/search?q=httt%2Fwww.biophysics&ie=utf-8&oe=utf-8&client=firefox-b-ab.
2	https://www.google.com/search?q=http%2F+radiation+physics&ie=utf-8&oe=utf-8&client=firefox-b-ab.

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**							
Programme	M.Sc.,	Programme Code	PPH		Regulations	2022-2023		
Department	Physics		Semester			II		
Course Code	Course Name		Periods per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
22P2PH04	**ELECTROMAGNETIC THEORY AND PLASMA PHYSICS**		6	0	0	5	25	75	100
COURSE OBJECTIVES	1. To provide the basic skills required to understand, develop, and design Electromagnetic materials. 2. To enhance their search interest in electricity and magnetism.							
POs	**PROGRAMME OUTCOME**							
PO 1	Capable of demonstrating the basic concept sand comprehensive knowledge from undergraduate programme of study.							
PO 2	Ability to express thoughts and ideas effectively Communicate with others using appropriate media and interpret the idea in clear and concise manner.							
PO 3	To identify the relevant assumptions to formulate the arguments by following scientific approach to knowledge development.							
PO 4	Capacity to solve different kinds of non-familiar problems and apply to real life situations.							
PO 5	Ability to evaluate the reliability and relevance of evidence, analyze and synthesize data from a variety of sources then draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.							
PO 6	To define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, predict cause-and-effect relationships and ability to plan, execute and report the results of an experiment.							
PO 7	Ability to work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group and act together as a group.							
PO 8	Ability to analyse, interpret and draw conclusions from quantitative / qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.							
PO 9	Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.							
PO 10	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources and useappropriate software for analysis of data.							
PO 11	Ability to work independently, identifies appropriate resources required for a project, and manage a project through to completion.							
PO 12	Capability to effectively engage in a multicultural society and interact respectfully with diverse groups.							
PO 13	Capable of demonstrating the ability to identify ethical issues related to ones work, avoid unethical behavior such as fabrication.							
PO 14	Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision.							
PO 15	Ability to acquire knowledge and skills, including how to learn, that are necessary for participating in learning activities throughout life.							

COs	COURSE OUTCOME
CO 1	To understand the concept of electrostatics. Acquire conceptual knowledge molecular polarisability. Analyze the Laplace equation.
CO 2	Understand the techniques biot - savarts and amperes circuital law.
CO 3	Understand the faraday laws of induction and evaluate the Maxwells equation.
CO 4	Understand the propagation of waves in rectangular wave guides. Apply the concept of wave guides in homogeneous wave equation.
CO 5	Acquire the knowledge about Plasma physics. Apply the Plasma or welding techniques.
Pre-requisites	To Acquire idea about Electrodynamics.

Knowledge Levels

1.Remembering, 2.Understanding, 3.Applying, 4.Analyzing, 5.Evaluating, 6.Synthesizing

CO / PO / KL Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	KLs	POs	KLs
CO 1	1	PO 1	1
		PO 2	2
		PO 3	2
CO 2	2	PO 4	3
		PO 5	5
		PO 6	1
CO 3	2	PO 7	6
		PO 8	4
		PO 9	5
CO 4	3	PO 10	1
		PO 11	2
		PO 12	2
CO 5	3	PO 13	3
		PO 14	3
		PO 15	6

CO / PO Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium,1- weak)

COs	Programme Outcome (POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO2	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO3	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO4	1	2	2	3	1	1	1	2	1	1	2	2	3	3	1
CO5	1	2	2	3	1	1	1	2	1	1	2	2	3	3	1

Course Assessment Methods

Direct

1. Continuous Assessment Test - I, II & Model
2. Assignment
3. End Semester Examinations

Indirect

1. Course End Delivery

CONTENT OF THE SYLLABUS			
Unit - I	**ELECTROSTATICS**	**Periods**	**14**
	Coulombs law - Field due to point and continuous charges - Gauss Law and its application - Laplace and Poissons equations - Solution of Laplace equation in spherical Coordinates - Point charge in front of a conducting sphere - Multipole expansion - Electrostatic energy - Dielectrics - Polarization and Displacement vectors, Boundary conditions - Dielectric sphere in a uniform field - Molecular polarizability and Electrical susceptibility - Clausis- Mossotti equation.		
Unit - II	**MAGNETOSTATICS**	**Periods**	**10**
	Biot-Savarts law - Divergence and curl of magnetic induction - Magnetic vector potential - Amperes circuital law - Magnetic field of a localized current distribution - Magnetic moment and force on a current distribution in an electric field - Magneto static energy - Magnetic induction and Magnetic field in a macroscopic media - Concept of magnetic dipole - Boundary conditions - Uniformly magnetized sphere - Magnetic Scalar & Vector Potential - Characteristics.		
Unit - III	**ELECTROMAGNETICS**	**Periods**	**10**
	Faradays law of induction - Maxwell's equation in free space and isotropic media - Maxwell's displacements current - Vector and Scalar potential - Boundary conditions on the field at interfaces - Relation between field theory and circuit theory - Gauge transformation, Lorentz Gauge - Coulomb gauge – Conservation laws fora system of charges - Poynting theorem.		
Unit - IV	**WAVE PROPAGATION**	**Periods**	**14**
	Propagation of an electromagnetic wave in free space - Conducting and Non conducting medium - Skin depth, Reflection and Transmission at dielectric boundaries - Polarization - Fresnels Law - Interference, Coherence and Diffraction - Guided waves - Wave guides - Propagation of waves in rectangular wave guide.		
Unit - V	**PLASMA PHYSICS**	**Periods**	**12**
	Plasma - Debye length - Plasma oscillations - Plasma behavior in a magnetic field - Boltzmann equation – Magneto hydrodynamic equations - Electron plasma oscillations - Debye shielding problem - Plasma confinement in a magnetic field – Pinch effect - Magneto hydrodynamic waves - Alfven waves – Dynamics of charged particle in uniform electromagnetic fields - Plasma arc welding technique.		
	Total Periods		**60**

TEXT BOOKS	
1	Introduction to Electrodynamics, Griffith, Prentice Hall of India, (2015).
2	Electromagnetic Waves and Fields, Paul Corson and Dale, CBS Publishers, (2005).

REFERENCES	
1	Basic Electromagnetics with Application, N. Narayana, Prentice Hall of India, (2001).
2	Electromagnetic Theory and Applications, Umesh Sinha, Tech India Publications, (2005).

E-REFERENCES	
1	https://www.google.com/search?q=http%2F+electromagnetic+theory&ie=utf-8&oe=utf-8&client=firefox-b-ab
2	.https://www.google.com/search?q=hppt%2F+magnetostatics&ie=utf-8&oe=utf-8&client=firefox-b-ab

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**							
Programme	M.Sc.,	Programme Code	PPH		Regulations	2022-2023		
Department	Physics		Semester			III		
Course Code	Course Name		Periods per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
22P3PH07	**CONDENSED MATTER PHYSICS**		5	0	0	4	25	75	100
COURSE OBJECTIVES	1. This subject provides an advanced introduction to condensed matter physics. 2. To challenge the students provide a foundation for further advanced studies.							
POs	**PROGRAMME OUTCOME**							
PO 1	Capable of demonstrating the basic concepts and comprehensive knowledge from undergraduate programme of study.							
PO 2	Ability to express thoughts and ideas effectively Communicate with others using appropriate media and interpret the idea in clear and concise manner.							
PO 3	To identify the relevant assumptions to formulate the arguments by following scientific approach to knowledge development.							
PO 4	Capacity to solve different kinds of non-familiar problems and apply to real life situations.							
PO 5	Ability to evaluate the reliability and relevance of evidence, analyse and synthesize data from a variety of sources then draw valid conclusions.							
PO 6	To define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, predict cause-and-effect relationships and ability to plan, execute and report the results of an experiment.							
PO 7	Ability to work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.							
PO 8	Ability to analyze, interpret and draw conclusions from quantitative / qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.							
PO 9	Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society.							
PO 10	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources and use appropriate software for analysis of data.							
PO 11	Ability to work independently, identifies appropriate resources required for a project, and manages a project through to completion.							
PO 12	Capability to effectively engage in a multicultural society and interact respectfully with diverse groups.							
PO 13	Capable of demonstrating the ability to identify ethical issues related to ones work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual proper tyrights.							

PO 14	Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision.
PO 15	Ability to acquire knowledge and skills, including how to learn, that are necessary for participating in learning activities throughout life.

COs	**COURSE OUTCOME**
CO 1	Acquire the knowledge about the energy bands. To understand the Kronig penny model.
CO 2	To Understand Drudes Lorentz Free electron theory. Analyze Thermionic Emission.
CO 3	To Understand the Langevin classical theory of diamagnetism. Apply the Guoys method in diamagnetism.
CO 4	Understand the concept of London equation. Apply the super conductors for commercial applications.
CO 5	To Understand and Apply the qualitative ideas of MEMs spintronics.
Pre-requisites	To Acquire idea about materials science

Knowledge Levels			
1.Remembering, 2.Understanding, 3.Applying, 4.Analyzing, 5.Evaluating, 6.Synthesizing			
CO / PO / KL Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)			
COs	*KLs*	*POs*	*KLs*
CO 1	1	*PO 1*	*1*
		PO 2	*2*
		PO 3	*2*
CO 2	2	*PO 4*	*3*
		PO 5	*5*
		PO 6	*1*
CO 3	2	*PO 7*	*6*
		PO 8	*4*
		PO 9	*5*
CO 4	3	*PO 10*	*1*
		PO 11	*2*
		PO 12	*2*
CO 5	5	*PO 13*	*3*
		PO 14	*3*
		PO 15	*6*

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	**Programme Outcome (POs)**														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15
CO1	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO2	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1

CO3	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO4	1	2	2	3	1	1	1	2	1	1	2	2	3	3	1
CO5	1	1	1	1	3	1	2	2	3	1	1	1	1	1	2

Course Assessment Methods

Direct

1. Continuous Assessment Test - I, II & Model Exam.
2. Assignment.
3. End Semester Examinations.

Indirect

1. Course End Delivery

CONTENT OF THE SYLLABUS			
Unit - I	**ELECTRON ENERGY BANDS**	**Periods**	**12**
	Fundamentals of crystailline states - Bravais lattice - Miller indices –Simple crytal structure (SC,BCC,FCC)-Basic concepts of energy bands - Fermi surface - Density of states - The Blochs Theorm - Kronig Penney model - Brillouin zones - reciprocal lattice - Energy bands in a general periodic potential - Motion of an electron in one dimensional lattice - Effective mass of an electron - Effective band gap and band overlapping - Anomalous skin effect - De Hass van Alphen effect.		
Unit - II	**FREE ELECTRON THEORY OF METALS**	**Periods**	**12**
	Free electron in metals - Drude Lorentz free electron theory - Electrical conductivity - Thermal conductivity- Weidemann Franz law -Sommerfield free electron theory – Mattiessens Rule- Thermionic emission - Relaxation time - Collision time - Mean free path -Quantum theory of free electrons- Escapeofelectronsfrommetal-Potentialenergyofanelectronoutsidethe metal- Dulong and Petit law –Debye theory- Einstein theory of specific heat		
Unit - III	**BAND THEORY OF SEMICONDUCTORS**	**Periods**	**12**
	Introduction Band structure of semiconductors Fermi –Dirac Distribution law – intrinsic semiconductor: carrier concentration – electrical Conductivity – Extrinsic semiconductor: Bandgap determination- derivation of carrier concentration for P-type and n-type semiconductor- the variation of Fermi level with temperature – hall effect- determination of Hall coefficient and its applications.		
Unit - IV	**DIAMAGNETISM, PARAMAGNETISM ANDFERROMAGNETISM**	**Periods**	**12**
	Diamagnetism -Langevin classical theory of Diamagnetism - Paramagnetism - Weiss theory of paramagnetism –Quantum theory of Paramagnetism –Demagnetization of a paramagnetic salt – Determination of susceptibility of para and diamagnetism using Guoys method - Ferromagnetism - Quantum theory of ferromagnetism - Curie – Weisslaw - Weiss molecular field– Domain theory- Ferromagnetic domains - Antiferromagnetism –Ferrimagnetism.		

Unit – V	**SUPERCONDUCTIVITY AND SPINTRONICS**	**Periods**	**12**
	Superconductivity and its historical perspective - Critical Temperature - Persistent current - Energy gap and its Temperature dependence - Type I and Type II superconductors - BCS theory - Flux quantization – London equation - DC and AC Josephson effect High temperature Superconductors – Ceramic Super Conductors - Applications: SQUID - High temperature. **Spintronics :** Electron spin in Solid - Spin relaxation and spin de-spacing – Spintronic devices		
	Total Periods		**60**

TEXT BOOKS	
1	Solid State Physics - S.O. Pillai, New Age Publication, 2nd Edition, 2002.
2	Solid State Physics - " Gupta &Saxeena, PragattiPraashan, 9th Edition, 2004.
REFERENCES	
1	Introduction to Solid State Physics - C.Kittel (John Wiley and Sons), 7th Edition, 2005.
2	Superconductivity Fundamentals and Applications Werner Buckel, Reinhold Kleiner –VCH Publications, 2nd revised and enlarged edition 2004.
E-REFERENCES	
1	https://physics.ku.edu/research/condensed-matter-physics.
2	https://physics.uiowa.edu/research/condensed-matter-and-materials-physics.

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**							
Programme	M.Sc.,	Programme Code	PPH		Regulations	2022-2023		
Department	Physics		Semester			III		
Course Code	Course Name		Periods per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
22P3PH08	**QUANTUM MECHANICS - II**		6	0	0	4	25	75	100
COURSE OBJECTIVES	1. To acquire knowledge of non-relativistic and relativistic quantum mechanics. 2. Theabilitytounderstandconceptsandtoperformcalculationsofscatteringofparticles.							
POs	**PROGRAMME OUTCOME**							
PO 1	Capable of demonstrating the basic concepts and comprehensive knowledge from undergraduate programme of study.							
PO 2	Ability to express thoughts and ideas effectively Communicate with others using appropriate media and interpret the idea in clear and concise manner.							
PO 3	To identify the relevant assumptions to formulate the arguments by following scientific approach to knowledge development.							
PO 4	Capacity to solve different kinds of non-familiar problems and apply to real life situations.							
PO 5	Ability to evaluate the reliability and relevance of evidence, analyze and synthesize data from a variety of sources then draw valid conclusions.							
PO 6	To define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, predict cause-and-effect relationships and ability to plan, execute and report the results of an experiment.							
PO 7	Ability to work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.							
PO 8	Ability to analyze, interpret and draw conclusions from quantitative / qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.							
PO 9	Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.							
PO 10	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources and use appropriate software for analysis of data.							
PO 11	Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.							
PO 12	Capability to effectively engage in a multicultural society and interact respectfully with diverse groups.							
PO13	Capable of demonstrating the ability to identify ethical issues related to ones work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights.							

PO 14	Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision.
PO 15	Ability to acquire knowledge and skills, including how to learn, that are necessary for participating in learning activities throughout life.
COs	**COURSE OUTCOME**
CO 1	To acquire the knowledge of emission and absorption of radiation.
CO 2	Analyse partial wave analyses, Evaluate scattering amplitude through scattering cross section.
CO 3	To acquire the knowledge of Symmetrical and anti-symmetrical wave function.
CO 4	Apply Klein-Gordon equation to find relativistic wave equation.
CO 5	To acquire the knowledge of quantization of the wave field.
Pre-requisites	To Acquire idea about materials science

Knowledge Levels			
1.Remembering, 2.Understanding, 3.Applying, 4.Analyzing, 5.Evaluating, 6.Synthesizing			
CO / PO / KL Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)			
COs	KLs	POs	KLs
CO 1	1	PO 1	1
		PO 2	2
		PO 3	2
CO 2	4	PO 4	3
		PO 5	5
		PO 6	1
CO 3	3	PO 7	6
		PO 8	4
		PO 9	5
CO 4	5	PO 10	1
		PO 11	2
		PO 12	2
CO 5	4	PO 13	3
		PO 14	3
		PO 15	6

CO / PO Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	Programme Outcome (POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO2	1	1	1	2	2	1	1	3	2	1	1	1	2	2	1
CO3	1	2	2	3	1	1	1	2	1	1	2	2	3	3	1
CO4	1	1	1	1	3	1	2	2	3	1	1	1	1	1	2
CO5	1	1	1	2	2	1	1	3	2	1	1	1	2	2	1

Course Assessment Methods			
Direct			
1. Continuous Assessment Test - I, II & Model Exam. 2. Assignment. 3. End Semester Examinations.			
Indirect			
1. Course End Delivery			
CONTENT OF THE SYLLABUS			
Unit - I	**THEORY OF RADIATION**	**Periods**	**12**
	Emission & Absorption of radiation -– Electric dipole approximation – Einstein's Transition probabilities and A & B Coefficients – Selection rules – Interaction with matter - Spontaneous & Stimulated emissions – forbidden transitions. **Quantum theory of Valence Bond:** VB method – Hitler - London theory of Hydrogen molecule in VB method - Refinements of Simple MO and VB approximations.		
Unit - II	**SCATTERING THEORY**	**Periods**	**12**
	Scattering cross section - differential and total cross sections - Scattering amplitude – Kinematics of scattering process - Green's function - Partial wave analysis - Phase shifts - Scattering by Coulomb potential - Low energy scattering: Scattering length and effective range - Scattering by a perfectly rigid sphere.		
Unit - III	**MANY ELECTRON ATOMS**	**Periods**	**12**
	Indistinguishable particles - Symmetrical and Anti symmetrical wave functions - Paulis Exclusion principle - Inclusion of spin - Spin functions for two electrons - three electrons - Helium atom - Central field approximation - Thomas Fermi model of the atom - Hatree Equation - Hatree - Fock Equation - Kohn-Sham.		
Unit - IV	**RELATIVISTIC WAVE EQUATION**	**Periods**	**12**
	Klein - Gordan Equation – Dirac's equation for a free particle - Dirac Matrics - Covariant form of dirac equation - Probability density and current density - Plane wave solution - significance of negative eigen states - Hydrogen atom.		
Unit - V	**QUANTUM FIELD THEORY**	**Periods**	**12**
	Quantization of the wave fields - Classical Lagrangian equation– Classical Hamiltonian equation - Field Quantization of the non relativistic Schrodinger equation - Creation, Destruction and Number Operators – Photons - Anti Commutation Relations - Quantization of Electromagnetic Field – Quantum Entanglement.		
	Total Periods		**60**

TEXT BOOKS	
1	Quantum Mechanics G Aruldhas - Prentice Hall of India, (2006).
2	Quantum Mechanics “Satyaprakash - Sultan Chand Publishers, (2013).
3	Quantum Mechanics “Gupta Kumar Sharma - JaiprakashNath Publications,Meerut, (2013).
REFERENCES	
1	A text Book of Quantum Mechanics “P. M.Mathews & K.Venkatesanâ Tata Mc Graw Hill, (2004).
2	Introduction to Quantum Mechanics “David J.Griffths â€“ Pearson Prentice Hall, 2nd edition, (2009).
3	Quantum Mechanics “L. I. Schiff - Tata Mc Graw Hill, (2010).
E-REFERENCES	
1	https://nptel.ac.in/syllabus/115104045/
2	https://www.ntnu.edu/studies/courses/TFY4205/
3	https://www.ntnu.edu/studies/courses/TFY4205/

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)

Elayampalayam, Tiruchengode-637 205.

Programme	M.Sc.,	Programme Code	PPH	Regulations	2022-2023
Department	Physics		Semester		III

Course Code	Course Name	Periods per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
22P3PH09	**MICROPROCESSOR AND MICROCONTROLLER**	4	0	0	4	25	75	100

COURSE OBJECTIVES	1. The Basic knowledge and buildings blocks of computers and its processors. 2. To operate the processors and controllers with basic idea.
POs	**PROGRAMME OUTCOME**
PO 1	Capable of demonstrating the basic concepts and comprehensive knowledge from undergraduate programme of study.
PO 2	Ability to express thoughts and ideas effectively Communicate with others using appropriate media and interpret the idea in clear and concise manner.
PO 3	To identify the relevant assumptions to formulate the arguments by following scientific approach to knowledge development.
PO 4	Capacity to solve different kinds of non-familiar problems and apply to real life situations.
PO 5	Ability to evaluate the reliability and relevance of evidence, analyze and synthesize data from a variety of sources then draw valid conclusions.
PO 6	To define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, predict cause-and-effect relationships.
PO 7	Ability to work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group.
PO 8	Ability to analyze, interpret and draw conclusions from quantitative/qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.
PO 9	Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society.
PO 10	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources and use appropriate software for analysis of data.
PO 11	Ability to work independently, identifies appropriate resources required for a project, and manages a project through to completion.
PO 12	Capability to effectively engage in a multicultural society and interact respectfully with diverse groups.
PO 13	Capable of demonstrating the ability to identify ethical issues related to ones work, avoid unethical behavior as fabrication.
PO 14	Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision.
PO 15	Ability to acquire knowledge and skills, including how to learn, that are necessary for participating in learning activities throughout life.

COs	**COURSE OUTCOME**
CO 1	To acquire the knowledge of evolution of microprocessor. Understand the hardware and software interrupts.
CO 2	To get the knowledge about Assembly language. Understand the instruction set of 8085.Apply the 8bit addition in8085.
CO 3	To acquire the knowledge of INTEL 8257.Apply the direct memory access in Data transfer.
CO 4	To get the knowledge about applications of microprocessor architecture of 8051. Understand the counters andtimers.
CO 5	To get the knowledge about architecture of 8051 and instruction set of 8051.Apply the ascending and descending order program in8051.
Pre-requisites	To Acquire idea about microprocessor programming

Knowledge Levels

1.Remembering, 2.Understanding, 3.Applying, 4.Analyzing, 5.Evaluating, 6.Synthesizing

CO / PO / KL Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	KLs	POs	KLs
CO 1	1	PO 1	1
		PO 2	2
		PO 3	2
CO 2	5	PO 4	3
		PO 5	5
		PO 6	1
CO 3	1	PO 7	6
		PO 8	4
		PO 9	5
CO 4	3	PO 10	1
		PO 11	2
		PO 12	2
CO 5	2	PO 13	3
		PO 14	3
		PO 15	6

CO / PO Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	**Programme Outcome (POs)**														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO2	1	1	1	1	3	1	2	2	3	1	1	1	1	1	2
CO3	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO4	1	2	2	3	1	1	1	2	1	1	2	2	3	3	1
CO5	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1

Course Assessment Methods
Direct
1. Continuous Assessment Test - I, II & Model 2. Assignment 3. End Semester Examinations
Indirect
1. Course End Delivery

CONTENT OF THE SYLLABUS			
Unit - I	**EVOLUTION AND ARCHITECTURE OF MICROPROCESSORS 8085**	**Periods**	**12**
	Evolution of Microprocessors - INTEL 8085 microprocessor - Pin configuration - Pins and their functions - Bus system - Control and status signals - Externally initiated signals including interrupts - Architecture - ALU - Flags - Registers. Timing and Sequencing: Instruction cycle, Machine cycle -Halt state and Wait state. **Interrupts:** Types of interrupts - Hardware and Software interrupts - masking and unmasking interrupts.		
Unit - II	**INSTRUCTION SETS & PROGRAMMING OF MICROPROCESSOR 8085**	**Periods**	**12**
	Assembly language - Instruction sets of 8085 - Stacks - Counters - Subroutines – MACRO - Delay Subroutine - Examples of Assembly language Programming - - 16 bit Addition - 16 bit Subtraction - 16 bit Multiplication - 16 bit Division – The Largest and Smallest number in a data array - Ascending and Descending orders of a set of arrays -Sum of a series in arrays- Factorial of a given number.		
Unit - III	**PERIPHERAL DEVICES AND THEIR INTERFACING**	**Periods**	**12**
	Address space - Partitioning - interfacing - Memory and I/O interfacing -I/O ports: Non programmable I/O port INTEL 8212 - Programmable Peripheral Interface (PPI) INTEL 8255 - Programmable Interval (Counter) Timer (PIT) INTEL 8253. Data Transfers: Types of parallel and serial data transfer schemes - Direct Memory Access (DMA) controller INTEL 8257. **Interfacing:** Working and Programming of PIC 8259 with 8085.		
Unit - IV	**INTERFACING DEVICES AND THEIR APPLICATIONS**	**Periods**	**12**
	Introduction – Water level indicator – Stepper motor – Traffic control – Analog to digital converter (ADC 0800) – Digital to analog converter (DAC 0800) – Seven segment display interfacing – Temperature measurement and control - stepper motor and its application		
Unit - V	**ARCHITECTURE AND MICROCONTROLLER 8051 PROGRAMMING**	**Periods**	**12**
	Introduction–Comparison between microcontroller and microprocessors - Key features of 8051 - Architecture of 8051 – Instruction set of 8051 – Assembly language programming – Sum of 'n' numbers - biggest and smallest in an array - Ascending and descending order program in an array – Software time delay.		
Total Periods			**60**

TEXT BOOKS	
1	Ramesh S.Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Fifth Edition, Penram International Publishing Pvt., Ltd., Mumbai (2000).
2	B. Ram, Fundamentals of Microprocessors and Microcontrollers, Ninth Edition, Dhanpat Rai Publications Pvt., Ltd., New Delhi (2019).
3	KennethJ.Ayala,The8051Microcontroller –Architecture, Programming & Applications, Third Edition, West Publishing Company, NewYork India (2007).
REFERENCES	
1	A.P.Godse and D.A.Godse, Microprocessors and Microcontrollers, Technical Publications, Pune (2015).
2	M.Gilmore, Microprocessor Principles and Applications, Second Edition, Mcgraw-Hill Education India Pvt., Ltd., New Delhi (1995).
3	Aditya P.Mathur, Introduction to Microprocessors, Third Edition, Mcgraw-Hill Education India Pvt., Ltd., New Delhi (2006).
4	Rafiquzzaman, Microprocessors - Theory and Applications: Intel and Motorola, Revised Edition, Prentice Hall of India Pvt., Ltd., New Delhi (1993).
5	Kenneth J. Ayala, The 8051 Microcontroller – Architecture, Programming & Applications, Third Edition, West Publishing Company, New York India (2007).
E-REFERENCES	
1	https://onlinecourses.nptel.ac.in/noc20_ec03.
2	https://www.elprocus.com/microprocessor-and-microcontroller/

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**							
Programme	M.Sc.,	Programme Code	PPH		Regulations	2022-2023		
Department	Physics		Semester			III		
Course Code	Course Name		Periods per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
22P3PHED1	**EDC : SOLAR ENERGY**		4	0	0	4	25	75	100
COURSE OBJECTIVES	1. Energy resources around us. 2. Threatening to our energy resources. 3. How to conserve energy.							
POs	**PROGRAMME OUTCOME**							
PO1	Capable of demonstrating the basic concepts and comprehensive knowledgefrom undergraduate Programme of study.							
PO2	Ability to express thoughts and ideas effectively Communicate with others using appropriate media.							
PO3	To identify the relevant assumptions to formulate the arguments by following scientific approach to Knowledge development.							
PO4	Capacity to solve different kinds of non-familiar problems and apply to real life situations.							
PO5	Ability to evaluate the reliability and relevance of evidence, analyse and synthesize data from a variety of sources.							
PO6	To define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data.							
PO7	Ability to work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group.							
PO8	Ability to analyze, interpret and draw conclusions from quantitative / qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.							
PO9	Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society							
PO10	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources.							
PO11	Ability to work independently, identifies appropriate resources required for a project, and manage a project through to completion.							
PO12	Capability to effectively engage in a multicultural society and interact respectfully with diverse groups.							
PO13	Capable of demonstrating the ability to identify ethical issues related to ones work, avoid unethical behavior such as fabrication.							
PO14	Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision.							
PO15	Ability to acquire knowledge and skills, including how to learn, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning.							

COs	**COURSE OUTCOME**
CO 1	Acquire the knowledge of energy sources. Understand the concept of Geothermal and wind energy.
CO 2	Acquire the knowledge of renewable energy sources. Apply solar thermal energy in solar cooker and solar pond.
CO 3	To get the knowledge of photovoltaic effect and synthesis the solar cells.
CO 4	To get knowledge of bio mass energy .Understand the biomass conversion technology.
CO 5	To acquire the knowledge of energy storage mechanism and understand the storage devices.
Pre-requisites	Get Knowledge about various energy.

Knowledge Levels

1.Remembering, 2.Understanding, 3.Applying, 4.Analyzing, 5.Evaluating, 6.Synthesizing

CO / PO / KL Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	KLs	POs	KLs
CO 1	1	PO 1	1
		PO 2	2
		PO 3	2
CO 2	3	PO 4	3
		PO 5	5
		PO 6	1
CO 3	6	PO 7	6
		PO 8	4
		PO 9	5
CO 4	2	PO 10	1
		PO 11	2
		PO 12	2
CO 5	2	PO 13	3
		PO 14	3
		PO 15	6

CO / PO Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	Programme Outcome (POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO2	1	2	2	3	1	1	1	2	1	1	2	2	3	3	1
CO3	1	1	1	1	2	1	1	1	2	1	1	1	1	1	3
CO4	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO5	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1

Course Assessment Methods

Direct

1. Continuous Assessment Test I, II &Model Exam. 2. Assignment. 3. End Semester Examinations.
Indirect
1. Course End Delivery

CONTENT OF THE SYLLABUS			
Unit - I	**INTRODUCTION TO ENERGY SOURCES**	**Periods**	**9**
	Classification of Energy sources - Worlds reserve of commercial energy sources and their availability - Geothermal energy - wind energy - Ocean thermal energy conversion - Energy from waves and tides (basic ideas) - Merits and Demerits.		
Unit - II	**SOLAR THERMAL ENERGY**	**Periods**	**9**
	Introduction about thermal properties - Renewable energy sources - Solar energy - Solar water heater - Solar Pumping - Solar furnace - Solar space heating and cooling - Solar thermal technologies - Solar cooker – Solar Pond - Merits and Demerits of solar energy.		
Unit - III	**SOLAR CELL**	**Periods**	**9**
	Introduction about semiconductor - Photo voltaic effect - Performance of solar cell - Solar cell Parameter - Solar cell characteristics and efficiency – Choice of materials for solar cell - Basic requirements for obtaining an effective solar cell - Power generation by using solar cell.		
Unit - IV	**BIOMASS ENERGY FUNDAMENTALS**	**Periods**	**9**
	Biomass energy - Classification - Photosynthesis - Biogas Generation - Introduction basic process and energetic, Advantages - Biomass conversion technology – Wet and dry process - Gobar gas and its Applications - Advantages and Disadvantages of biomass energy.		
Unit - V	**ENERGY STORAGE**	**Periods**	**9**
	Introduction - Liquid media storage - Solid media storage - Ground collector - Chemical storage-Capacitor, Electromagnets-Superconducting Magnet Energy Storage (SMES)systems.		
	Total Periods		**45**

TEXT BOOKS	
1	G.D. Rai, Non Conventional Energy Sources, 4th, 5th Edition, (2011).
2	G.D. Rai, Solar Energy Utilization, 5th Edition, (2011).
3	S.P. Sukhatme, Solar Energy, Tata McGraw Hill Publishing Company, 3rd Edition, (2005).
REFERENCES	
1	1. D.S. Chauhan, S.K. Srivastava, Non Conventional Energy Sources, Ed.V, first edition, (2004).
2	2. Solar Energy, Fundamentals, Design, Modelling and Applications, G.N.Tiwari, Narosa Publications, (2004).
E-REFERENCES	
1	https://www.renewableenergyworld.com/solar-energy/tech.html
2	https://en.wikipedia.org/wiki/Solar_power

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)

Elayampalayam, Tiruchengode-637 205.

Programme	M.Sc.,	Programme Code	PPH	Regulations	2022-2023
Department	Physics		Semester		IV

Course Code	Course Name	Periods per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
22P4PH10	**NUCLEAR AND PARTICLE PHYSICS**	6	0	0	5	25	75	100

COURSE OBJECTIVES	1. Explain central concepts laws and model sin nuclear and particle physics. 2. Use basic laws and relations to solve simple problems
POs	**PROGRAMME OUTCOME**
PO 1	Capable of demonstrating the basic concepts and comprehensive knowledge from undergraduate programme of study.
PO 2	Ability to express thoughts and ideas effectively Communicate with others using appropriate media and interpret the idea in clear and concise manner.
PO 3	To identify the relevant assumptions to formulate the arguments by following scientific approach to knowledge development.
PO 4	Capacity to solve different kinds of non-familiar problems and apply to real life situations.
PO 5	Ability to evaluate the reliability and relevance of evidence, analyses and synthesize data from a variety of sources then draw valid conclusions.
PO 6	To define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, predict cause-and-effect relationships.
PO 7	Ability to work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group.
PO 8	Ability to analyze, interpret and draw conclusions from quantitative / qualitative data and critically evaluates ideas, evidence and experiences from an open-minded and reasoned perspective.
PO 9	Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.
PO 10	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources and use appropriate software for analysis of data.
PO 11	Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.
PO 12	Capability to effectively engage in a multicultural society and interact respectfully with diverse groups.
PO 13	Capable of demonstrating the ability to identify ethical issues related to ones work, avoid unethical behavior as fabrication.
PO 14	Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision.
PO 15	Ability to acquire knowledge and skills, including how to learn, that are necessary for participating in learning activities throughout life.

COs	COURSE OUTCOME
CO 1	To acquire the knowledge of nuclear models. Analyze the collective models bhor and Mottelson.
CO 2	Understand the nuclear reaction and nuclear mechanism and analyze the partial wave of nuclear reaction.
CO 3	To acquire knowledge of nature of nuclear forces. Understand the NP scattering Evaluate Yukawa potential.
CO 4	Understand the Gamow's theory of alpha decay. Analyze the comparative half-lives.
CO 5	Acquire the knowledge of elementary particles and understand the weak and strong interactions.
Pre-requisites	To Acquire idea about nuclear and particle physics

Knowledge Levels

1.Remembering, 2.Understanding, 3.Applying, 4.Analyzing, 5.Evaluating, 6.Synthesizing

CO / PO / KL Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	KLs	POs	KLs
CO 1	1	PO 1	1
		PO 2	2
		PO 3	2
CO 2	2	PO 4	3
		PO 5	5
		PO 6	1
CO 3	1	PO 7	6
		PO 8	4
		PO 9	5
CO 4	5	PO 10	1
		PO 11	2
		PO 12	2
CO 5	4	PO 13	3
		PO 14	3
		PO 15	6

CO / PO Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, weak)

COs	Programme Outcome (POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO2	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO3	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO4	1	1	1	1	3	1	2	2	3	1	1	1	1	1	2
CO5	1	1	1	2	2	1	1	3	2	1	1	1	2	2	1

Course Assessment Methods

Direct

1. Continuous Assessment Test - I, II & Model
2. Assignment
3. End Semester Examinations

Indirect
1. Course End Delivery

CONTENT OF THE SYLLABUS			
Unit - I	**NUCLEAR PROPERTIES AND MODELS**	**Periods**	**12**
	Basic nuclear properties: Size, shape and charge distribution-spin and parity-determination of nuclear mass-binding energy - nuclear stability- Mass Parabola - Liquid drop model - Semi empirical mass formula - Shell Model - Prediction of Magic numbers and energy levels by shell model - Prediction and failure of the shell model - Optical Model - Introduction to collective model - Collective model of Bohr and Mottelson.		
Unit - II	**NUCLEAR REACTIONS**	**Periods**	**12**
	Nuclear reactions and reaction mechanism - Types of reactions and conservation laws – Reciprocity theorem - Energetic of nuclear reactions -Q-value equation - Scattering and reaction cross sections - Compound nucleus reactions - Direct reactions Stripping, Pick up reactions - Partial wave analysis of nuclear reaction cross – section – Breit-Wigner one level formula - continuum theory of nuclear reaction.		
Unit - III	**NUCLEAR INTERACTIONS**	**Periods**	**12**
	Nature of Nuclear forces - Exchange forces - Two body problems - ground state of deuteron - Magnetic moment - Quadrupole moment – Nucleon -nucleon interaction: NP scattering, PP scattering at low energy, non- central - Meson theory of nuclear forces - Effective range theory - Spin dependence of nuclear forces-Charge independence and charge symmetry of nuclear forces.		
Unit - IV	**NUCLEAR DECAY**	**Periods**	**12**
	Gamow's theory of alpha decay - Fermi's theory of beta decay - Total decay rate - Mass of the neutrino - Angular momentum and parity selection rules - Allowed and forbidden decays - Comparative half-lives – Gamma decay - Neutrino Hypothesis – Helicity - Non-conservation of parity - Multipole transitions in nuclei - Internal conversion - Nuclear isomerism.		
Unit - V	**PARTICLE PHYSICS**	**Periods**	**12**
	Types of interaction between elementary particles -Hadrons-Leptons-Mesons-Baryons- Hyperons-Pions- Symmetries and conservation laws-Elementary ideas of CP and CPT invariance - Isospin multiples – SU(2), SU (3) Multiples Gell-Mann-Okubo mass formula for octet and decuplet-Quark model- color and flavor.		
	Total Periods		**60**

TEXT BOOKS	
1	Satya Prakash, Nuclear Physics and Particle Physics, First Edition, Sultan Chand & Sons, New Delhi (2005).
2	S.L.Kakani and Shubhra Kakani, Nuclear and Particle Physics, Second Edition, Viva Books Pvt., Ltd., New Delhi (2013).
3	M.L.Pandya, R.P.S.Yadav and Amiya Dash, Elements of Nuclear Physics, Kedar Nath Ram Nath, Meerut (2020).
4	D.C.Tayal, Nuclear and Particle Physics, Second Edition, Himalaya Publishing House, Mumbai (2020).
REFERENCES	
1	Kenneth S.Krane, Introductory Nuclear Physics, Wiley India Pvt., Ltd., New Delhi (2008).
2	David Griffiths, Introduction to Elementary Particles, Second Edition, John Wiley and songs, New York (2008).
3	S.N.Ghoshal, Nuclear Physics, S.Chand Publishing Company, New Delhi (2019).
4	H.S.Hans, Nuclear Physics: Experimental and Theoretical, Revised Second, New Age International Publishers Pvt., Ltd., New Delhi (2019).
5	S.B.Patel, Nuclear Physics: An introduction, Second Edition, New Age International Publishers Pvt., Ltd., New Delhi (2011).
6	R.R.Roy and B.P.Nigam, Nuclear Physics, New Age International Publishers Pvt., Ltd., New Delhi (2005).
E-REFERENCES	
1	https://onlinecourses.nptel.ac.in/noc20_ph02/course
2	https://en.wikipedia.org/wiki/Particle_physics

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)

Elayampalayam, Tiruchengode-637 205.

Programme	M.Sc.,	Programme Code	PPH	Regulations	2022-2023
Department	Physics		Semester		IV

Course Code	Course Name	Periods per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
22P4PH11	**COMMUNICATION ELECTRONICS**	6	0	0	5	25	75	100

COURSE OBJECTIVES	1. The working principles of communication systems. 2. How to handle the communication elements.
POs	**PROGRAMME OUTCOME**
PO 1	Capable of demonstrating the basic concepts and comprehensive knowledge from undergraduate programme of study.
PO 2	Ability to express thoughts and ideas effectively Communicate with others using appropriate media.
PO 3	To identify the relevant assumptions to formulate the arguments by following scientific approach to knowledge development.
PO 4	Capacity to solve different kinds of non-familiar problems and apply to real life situations.
PO 5	Ability to evaluate the reliability and relevance of evidence analyses and synthesize data from a variety of sources.
PO 6	To define problems, formulate hypotheses, test hypotheses, analyses, interpret and draw conclusions from data.
PO 7	Ability to work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group.
PO 8	Ability to analyses, interpret and draw conclusions from quantitative / qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.
PO 9	Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society.
PO 10	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources.
PO 11	Ability to work independently, identifies appropriate resources required for a project, and manage a project through to completion.
PO 12	Capability to effectively engage in a multicultural society and interact respectfully with diverse groups
PO 13	Capable of demonstrating the ability to identify ethical issues related to ones work, avoid unethical behavior such as fabrication.
PO 14	Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision.
PO 15	Ability to acquire knowledge and skills, including how to learn, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning.

COs	**COURSE OUTCOME**
CO 1	Understand the frequency modulation and apply modulation system in BPSK and QPSK.
CO 2	Acquire the knowledge of single mode and multi-mode communication. Understand splicing and connectors.
CO 3	Analyze the reflex klystron and applying microwave system.
CO 4	Apply satellite communication system in RADAR.
CO 5	Apply mobile communication in digital cellular radios.
Pre-requisites	Laser in Medicine Communication Systems

Knowledge Levels

1.Remembering, 2.Understanding, 3.Applying, 4.Analyzing, 5.Evaluating, 6.Synthesizing

CO / PO / KL Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	KLs	POs	KLs
CO 1	2	PO 1	1
		PO 2	2
		PO 3	2
CO 2	1	PO 4	3
		PO 5	5
		PO 6	1
CO 3	4	PO 7	6
		PO 8	4
		PO 9	5
CO 4	3	PO 10	1
		PO 11	2
		PO 12	2
CO 5	3	PO 13	3
		PO 14	3
		PO 15	6

CO / PO Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

Course Assessment Methods

Direct

COs	**Programme Outcomes (PO)**														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO2	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO3	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO4	1	1	1	1	3	1	2	2	3	1	1	1	1	1	2
CO5	1	1	1	2	2	1	1	3	2	1	1	1	2	2	1

1. Continuous Assessment Test - I, II & Model Exam.
2. Assignment.
3. End Semester Examinations.

Indirect			
1. Course End Delivery			
CONTENT OF THE SYLLABUS			
Unit - I	**MODULATION SYSTEMS**	**Periods**	**12**
	Theory of Amplitude modulation - frequency modulation - phase modulation - Pulse code modulation - Pulse width modulation - Sampling theorem - low pass and band pass signals, PAM, Differential PCM delta modulation - Delta modulation - Adaptive Delta modulation - BPSK,QPSK.		
Unit - II	**FIBER OPTICS COMMUNICATION**	**Periods**	**12**
	Basics principle of Fiber Optics – Classification - Single mode and multimode, Step index and Graded index - Fiber Losses - Attenuation, Absorption, Leaky modes, Bending losses, Transmission losses, and Core and cladding losses. Propagation of Light in an Optical Fiber: Acceptance Angle – Numerical Aperture – Dispersion – Applications.		
Unit - III	**MICROWAVE COMMUNICATION SYSTEM**	**Periods**	**12**
	Microwave Generation - Multicavity Klystron - Reflex Klystron - Magnetron - Travelling Wave Tubes (TWT) – MASER - Microwave communication system - Analog Microwave Communication - LOS microwave system - OTH microwave system - Digital Hierarchies, Digital Microwave Systems, Bandwidth efficiency.		
Unit - IV	**SATELLITE COMMUNICATIONS**	**Periods**	**12**
	Orbital Satellites, Geostationary Satellites, Orbital Patterns, Look angles, Orbital Classifications, Spacing and frequency allocation, Radiation Pattern, foot prints, Satellite System link models, Satellite system link equation - Non-ideal system parameters - INSAT communications satellites - Channel Capacity – RADAR- Elements of a Radar System – Radar Equation - Cable TV, CCTV.		
	MOBILE COMMUNICATION	**Periods**	**12**
Unit - V	Evaluation and fundamentals - Cellular structure and planning - Frequency allocations – Propagation-Problems - Base station antennas and mobile antennas - Type of mobile system - Access method -TDMA, FDMA and CDMA – Internet Protocol Television – Wi-fi – 5 G (Basics ideas only)		
Total Periods			**60**

TEXT BOOKS	
1	Electronic Communication Systems â€“George Kennedy& Davis, Tata McGraw Hill, 4th Edition, (2006).
2	John M. Senior, Optical Fiber Communications, Second Edition, PHI, 6th Edition, (2009).
3	Wireless Communication Principles & Practice â€“Theodore S. Rappaport, 2nd Edition, (2002).
REFERENCES	
1	Taub and Schiling, Principles of Communication Systems, Second edition, Tata McGraw Hill, 3rd Edition, (2010).
2	Simon Haykin, Communication system, Third edition John Wiley & Sons, Inc. 4th Edition, (2007).
3	Wayne, Electronic Communication Systems, 6th Edition, (2004).
E-REFERENCES	
1	https://en.wikibooks.org/wiki/Communication_Systems.
2	https://www.elprocus.com/what-is-a-communication-system-and-its-basic-elements.

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**							
Programme	M.Sc.,	Programme Code	PPH		Regulations	2022-2023		
Department	Physics		Semester			IV		
Course Code	Course Name		Periods per Week		Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
22P4PHE03	**ELECTIVE: THIN FILM TECHNOLOGY**		4	0	0	4	25	75	100
COURSE OBJECTIVES	1. To examine the electrical properties in metallic thin films. 2. To explore the transport properties of semi Conducting and insulating film. 3. Toknowhowtheopticalpropertiesofthinfilmisutilizedinsolarcellapplications.							
POs	**PROGRAMME OUTCOME**							
PO 1	Capable of demonstrating the basic concepts and comprehensive knowledge from undergraduate programme of study.							
PO 2	Ability to express thoughts and ideas effectively Communicate with others using appropriate media and interpret the idea in clear and concise manner.							
PO 3	To identify the relevant assumptions to formulate the arguments by following scientific approach to knowledge development.							
PO 4	Capacity to solve different kinds of non-familiar problems and apply to real life situations.							
PO 5	Ability to evaluate the reliability and relevance of evidence, analyze and synthesize data from a variety of sources then draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.							
PO 6	To define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, predict cause and effect relationships and ability to plan, execute and report the results of an experiments							
PO 7	Ability to work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause and work efficiently a same member of a team.							
PO 8	Ability to analyze, interpret and draw conclusions from quantitative/qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.							
PO 9	Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.							
PO 10	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources and use appropriate software for analysis of data.							
PO 11	Ability to work independently, identifies appropriate resources required for a project, and manages a project through to completion.							
PO 12	Capability to effectively engage in a multicultural society and interact respectfully with diverse groups.							
PO 13	Capable of demonstrating the ability to identify ethical issues related to ones work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights.							

PO 14	Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision.
PO 15	Ability to acquire knowledge and skills, including how to learn, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social.
COs	**COURSE OUTCOME**
CO 1	Acquire the knowledge of preparation of thin film. Understand the construction and uses of vapour sources.
CO 2	Apply the deposition monitoring and control in micro balance.
CO 3	Analyze electrical conduction in thin metallic films.
CO 4	Understand DC conduction mechanism and analyze structure and optical properties of UV Spectrophotometer.
CO 5	Synthesis thin films for Solar cell application

Knowledge Levels			
1.Remembering, 2.Understanding, 3.Applying, 4.Analyzing, 5.Evaluating, 6.Synthesizing			
CO / PO / KL Mapping (3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)			
COs	KLs	POs	KLs
CO 1	2	PO 1	1
		PO 2	2
		PO 3	2
CO 2	1	PO 4	3
		PO 5	5
		PO 6	1
CO 3	4	PO 7	6
		PO 8	4
		PO 9	5
CO 4	3	PO 10	1
		PO 11	2
		PO 12	2
CO 5	3	PO 13	3
		PO 14	3
		PO 15	6

CO / PO Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

Course Assessment Methods

Direct

COs	**Programme Outcomes (PO)**														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO2	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO3	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO4	1	1	1	1	3	1	2	2	3	1	1	1	1	1	2
CO5	1	1	1	2	2	1	1	3	2	1	1	1	2	2	1

1. Continuous Assessment Test - I, II & Model Exam. 2. Assignment. 3. End Semester Examinations.	
Indirect	
1. Course End Delivery	

CONTENT OF THE SYLLABUS			
Unit - I	**THIN FILM FORMATION METHODS**	**Periods**	**12**
	Basics of thin film: Nucleation and growth of thin films Vacuum coating unit: Construction and uses of vapor sources – wire- crucible vacuum pumps and heated sources –measurement of Pressure – gauges. **Thin film preparation methods:** Physical vapor deposition (PVD) - Thermal evaporation; electron beam evaporation - Pulsed laser deposition; Ion beam assisted deposition - Chemical vapor deposition (CVD).		
Unit - II	**DEPOSITION MONITORING AND THICKNESS MEASUREMENT**	**Periods**	**8**
	Electrical methods: Quartz crystal monitor; Crystal oscillator thickness monitor- Resistance Monitor. **Optical methods:** Multiple Beam Interferometer, Fizeau - Tolansky technique - Fringes of equal chromatic order (FECO) method – Ellipsometry.		
Unit - III	**ELECTRICAL PROPERTIES OF THIN FILM**	**Periods**	**8**
	Influence of thickness on resistivity - Electrical conduction in thin metallic films - Resistivity of the metallic film - Sheet resistance - Hall effect - Calculation of mobility - DC conduction mechanism - Low field and high field conduction. - AC conduction mechanism. Temperature dependence of conductivity - Thermal treatment process: Breakdown mechanism in dielectric films.		
Unit - IV	**CHARACTERIZATION TECHNIQUES**	**Periods**	**11**
	Structural analysis: X-ray diffraction – powder diffraction - determination of lattice parameters - structure - X-ray photoelectron spectroscopy (XPS) – ftir Instrumentations. **Optical analysis:** Optical constants of thin films - UV spectrophotometer - Transmittance, absorption, determination of band gap. **Surface analysis:** Field Emission scanning Electron microscope (FESEM) - Transmission electron microscopy (TEM) - Atomic force microscopy (AFM).		
Unit - V	**APPLICATION OF THIN FILMS**	**Periods**	**9**
	Thin film resistors: Materials and Design of thin film resistors. **Thin film capacitors:** Materials - Capacitor structures-Capacitor yield and capacitor stability. **Fabrication and characteristics:** Thin film field effect transistors - Thin film solar cells - anti reflection coatings.		
	Total Periods		**48**

TEXT BOOKS	
1	Thin Film Fundamentals by A. Goswami.
2	Hand book of Thin films Technology: L I Maissel and R Clang.
3	Thin film Phenomena: K L Chopra.
4	Physics of thin films, vol. 12, Ed George Hass and others.
5	Thin films solar cells – K L Chopra and S R Das.

REFERENCES	
1	Physics of thin films, Vol. 12, First Edition Georg Hass Maurice H. Francombe John L. Vossen.
2	Thin films solar cells "K.L. Chopra and S. R. Das, 1983.
3	Vacuum deposition of thin films "L.Holland, 1956.

E-REFERENCES	
1	https://www.tno.nl/en/focus-areas/industry/expertise-groups/thin-film- technology/

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**								
Programme	M.Sc.,	Programme Code	PPH		Regulations	2022-2023			
Department	Physics		Semester			IV			
Course Code	Course Name		Periods per Week			Credit	Maximum Marks		
			L	T	P	C	CA	ESE	Total
22P2PHE07	**ELECTIVE: MEDICAL PHYSICS**		4	0	0	4	25	75	100
COURSE OBJECTIVES	1. To examine the particle accelerators. 2. To explore the construction of X-ray generator used in Diagnostic radiology. 3. To know about the radio isotopes, laser applications in medicine.								
POs	**PROGRAMME OUTCOME**								
PO 1	Capable of demonstrating the basic concepts and comprehensive knowledge from undergraduate programme of study.								
PO 2	Ability to express thoughts and ideas effectively Communicate with others using appropriate media and interpret the idea in clear and concise manner.								
PO 3	To identify the relevant assumptions to formulate the arguments by following scientific approach to knowledge development.								
PO 4	Capacity to solve different kinds of non-familiar problems and apply to real life situations.								
PO 5	Ability to evaluate the reliability and relevance of evidence, analyze and synthesize data from a variety of sources then draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.								
PO 6	To define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, predict cause and effect relationships and ability to plan, execute and report the results of an experiments								
PO 7	Ability to work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.								
PO 8	Ability to analyze, interpret and draw conclusions from quantitative /qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.								
PO 9	Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.								
PO 10	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources and use appropriate software for analysis of data.								
PO 11	Ability to work independently, identifies appropriate resources required for a project, and manages a project through to completion.								
PO 12	Capability to effectively engage in a multicultural society and interact respectfully with diverse groups.								
PO 13	Capable of demonstrating the ability to identify ethical issues related to ones work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights.								

PO 14	Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision.
PO 15	Ability to acquire knowledge and skills, including how to learn, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social.
COs	**COURSE OUTCOME**
CO 1	To learn the construction and working of different types of particle accelerators.
CO 2	To learn the construction of X-ray generator used in Diagnostic radiology.
CO 3	To learn the radioisotopes produced from the above equipment and their medical applications.
CO 4	Applications of Laser in Medicine.
CO 5	Applications of Ultrasound in Medicine.
Pre-requisites	To get knowledge about Medical Physics.

Knowledge Levels

1.Remembering, 2.Understanding, 3.Applying, 4.Analyzing, 5.Evaluating, 6.Synthesizing

CO / PO / KL Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	KLs	POs	KLs
CO 1	1	PO 1	1
		PO 2	2
		PO 3	2
CO 2	3	PO 4	3
		PO 5	5
		PO 6	1
CO 3	4	PO 7	6
		PO 8	1
		PO 9	1
CO 4	2	PO 10	1
		PO 11	1
		PO 12	1
CO 5	6	PO 13	1
		PO 14	1
		PO 15	1

CO / PO Mapping

(3/2/1 indicates the strength of correlation, 3-strong, 2-medium, 1-weak)

COs	**Programme Outcome (POs)**														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	1	1	3	1	3	3	3	3	3	3	3	3
CO2	1	2	2	3	1	1	1	1	1	1	1	1	1	1	1
CO3	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1
CO 4	3	2	1	1	2	1	1	2	1	3	1	1	1	1	1
CO 5	3	2	2	2	1	1	1	1	1	2	1	1	1	1	1

CONTENT OF THE SYLLABUS			
Unit-I	**X-RAYGENERATORS**	**Periods**	**10**
	Discovery - Production - Properties of X-rays - Characteristics and continuous spectra - Design of hot cathode X-ray tube - Basic requirements of medical diagnostic, therapeutic and industrial radiographic tubes - Rotating anode tubes - Hooded anode tubes - Rating of tubes – standard exposure charts, Limitations on loading Safety devices in X-ray tubes - Insulation and cooling of X-ray tubes.		
Unit-II	**PARTICLE ACCELERATORS**	**Periods**	**10**
	Particle accelerators for industrial ,medical and research applications - The Resonant transformer Cascade generator - Pelletron – Synchro – Cyclotron - Linear Accelerator – Klystron and magnetron – Travelling and Standing Wave Acceleration-Microtron - Working principle of Cyclotron and charged particle accelerators , Applications of cyclotrons in medicine, Types of Cyclotrons: Beam transport systems – Beam delivery systems –Energy slits. Computed Tomography, Positron emission tomography (PET).		
Unit-III	**RADIATION SOURCES AND THEIR MEDICAL APPLICATIONS**	**Periods**	**10**
	Radiation sources - Natural and artificial radioactive sources– Cyclotron produced isotopes (20 F, 13 N, 15 O, 11 C) -Fission products (137 Cs, 99 Mo, 131 I, 90 Sr) – Requirement for brachytherapy sources - Beta ray applicators – ophthalmic applicators (90 Sr, 125 I, 106 Ru etc.,).		
Unit-IV	**LASERSINMEDICINE**	**Periods**	**9**
	Lasers in medicine – applications of Ultrafast pulsed Lasers – Lasers in dermatology,oncology and cellbiology - Lasers in blood flow measurement-Fiberoptics in medicine - microscopy in medicine - birefringence - Fluorescence microscope -confocal microscope - Hazards of lasers and their safety measures.		
Unit-V	**ULTRASOUND IN MEDICINE**	**Periods**	**9**
	Production, properties and propagation of ultrasonic waves - Bioacoustics – Acoustical characteristics of human body - Ultrasonic Dosimetry - High power ultrasound in theraphy – Ultrasound cardiography (UCG) – Doppler effect – Double Doppler shift – Doppler systems – ultrasonic tomography – applications of ultrasound in medicine.		
	Total Periods		**48**

TEXT BOOKS	
1	F. M. Khan, The Physics of Radiation therapy, 3rd Edition, Lippincott Williams & Wikins, Philadelphia, 2003.
2	H. E. John and J. R. Cunningham, Physics of Radiology, 4th Edition, Charles C Thomas Pub. Ltd., 1983.
3	J. P. Woodcock, Ultrasonic, Medical Physics Handbook series 1, Adam Hilger, Bristol, 2002.

4	J. R. Greening, Medical Physics, North Holland Publishing Co., New York, 1999.
REFERENCES	
1	W. R. Hendee, Medical Radiation Physics, Year Book Medical Publishers Inc., London, 2003.
2	R. Pratesi and C. A. Sacchi, Lasers in Photo medicine and Photobiology, Springer Verlag, West Germany, 1980.

SEMESTER – I

Credit: 4

Max. Hours: 48

PRACTICAL – I: ADVANCED ELECTRONICS EXPERIMENTS

PAPER CODE: 22P1PHP01

1. FET Characteristics and construct FET amplifier circuit.
2. Design Phase shift oscillator.
3. Construct Schmitt trigger using IC 555 & IC 741.
4. Design square wave generator using IC 555 & IC741.
5. Design monostable multivibrator using IC 741 & IC 555.
6. Binary addition and subtraction using IC 7483.
7. BCD counter- Seven segment display.
8. UJT Characteristics and construct saw tooth wave oscillator.
9. Multiplexer and De-Multiplexer.
10. Decoder and Encoder.
11. Analog computation – Solving simultaneous equation.
12. Shift registers using 7476/7473 IC.
13. Study of Flip Flops using IC 7400.
14. Design second order butter worth active filter circuit – Low pass, high pass and band pass filters using IC 741.
15. Design of R/2R ladder and Binary weighted method of DAC using IC 741.
16. Photo diode and Photo transistors.

SEMESTER - II

PRACTICAL – II: ADVANCED PHYSICS EXPERIMENTS - I

Paper Code: 22P2PHP02
Credit: 4
Max. Hours: 48

1. Determine the Young's Modulus of the material of the given plate by forming elliptical fringes. Repeat the experiment at least twice by changing the position of the suspended masses.
2. Determine the Young's Modulus of the material of the given plate by forming hyperbolic fringes. Take 2 sets of readings.
3. Using the given experimental setup determine the value of Stefan's constant. Assuming the solar constant 'S'. Calculate the temperature of the SUN.
4. Find the thickness of the air film in FP etalon.
5. Determine the compressibility of the given solution by using an ultrasonic interferometer. Repeat the experiment at least for four different concentrations and hence draw the concentration vs. compressibility graph.
6. Determine the compressibility of the given four liquids/solution by using an ultrasonic interferometer.
7. Determine
   (a) Hall voltage and Hall coefficient
   (b) Number density of the charge carriers and
   (c) Hall angle and mobility.

   Repeat the experiment for a different value of magnetic field.
8. Measure the diameter of a circular aperture, the diameter of a thin wire and diameter of sleeve using Fresnel's diffraction phenomenon.
9. Determine the wavelength of the laser light by using transmission grating and determine the number of lines in a transmission grating.

SEMESTER - III

Credit: 4

Max. Hours: 48

PRACTICAL – III: MICROPROCESSOR EXPERIMENTS

Paper Code: 22P3PHP03

1. 8 Bit Decimal Addition and Subtraction.
2. 8 Bit Multi-byte Addition and Subtraction.
3. Number Conversion: BCD to Binary, Binary to BCD, ASCII to Hexadecimal and Hexadecimal to ASCII.
4. 16 bit Addition and Subtraction.
5. 16 bit Multiplication and Division.
6. 16 bit Square of a number and 16 bit Square root of a number.
7. Sum of simple series and Factorial of a number.
8. ADC interfacing.
9. Stepper motor interfacing.
10. Interfacing of an 8 bit DAC Converter and Waveform generation- Triangular, Saw tooth, Sine, Square, Rectangular.
11. Traffic light controller.
12. Finding the Largest/Smallest number in a data array.
13. Ascending/Descending order in a given array.
14. Multibyte decimal addition.
15. Data transfer Program.

SEMESTER - IV

PRACTICAL – IV: ADVANCED GENERAL EXPERIMENTS - II

Paper Code: 22P4PHP04

Credit: 4

Max. Hours: 48

1. Rydberg constant-grating –Hydrogen spectrum.
2. Magnetic susceptibility – Quincke's method.
3. Magnetic susceptibility – Guoy's method.
4. Band gap of a semiconductor – Four probe method.
5. Rydberg constant - Solar Spectrum.
6. Thermal conductivity of a good conductor – Forbe's method.
7. Coefficient of Viscosity - Searle's Viscometer.
8. Charge of an electron using Spectrometer.
9. Determination of wavelength - Michelson's Interferometer.
10. Charge of an electron - Milikan's oil drop method.
11. Compressibility of the Liquid - Ultrasonic Diffractometer.
12. Temperature Coefficient & Energy Band Gap of a Thermistor.