VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN

(AUTONOMOUS)

SCHEME OF EXAMINATIONS PG

PG AND RESEARCH DEPARTMENT OF PHYSICS

M.Sc., DEGREE – OBE SYLLABUS

2018 - 2019

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 framed Curriculum and Syllabi in consultation with all its stakeholders to cater the needs of the young women to fulfill the women empowerment and present Industrial needs to the local benefits. The students are empowering with confidence and required skills 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

The mission 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)

I. 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 a serious commitment of the student to take up challenging study 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.

I. SALIENT FEATURES

- ✓ Course is specially designed for a higher level Career Placement.
- ✓ Special Guest lectures 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.

III. 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 in 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.

IV. ELIGIBILITY FOR ADMISSION

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 some other University accepted by the syndicate as equivalent there to shall be permitted to be eligible.

V. 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.

VI. CONTINUOUS INTERNAL ASSESSMENT

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

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

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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

VII. 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)

VII. 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).

VIII. 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.

IX. CLASSIFICATION OF SUCCESSFUL CANDIDATES

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 2018 - 2019 (i.e.,) for the students who are to be admitted to the first year of the course during the academic year 2018 - 2019 and thereafter.

LIST OF CORE PAPRES

S.No	Code	Course Title
1.	18P1PH01	Mathematical Physics
2.	18P1PH02	Classical and Statistical Mechanics
3.	18P1PH03	Advanced Electronics
4.	18P2PH04	Electromagnetic Theory
5.	18P2PH05	Quantum mechanics –I
6.	18P2PH06	Spectroscopy
7.	18P3PH07	Condensed matter Physics
8.	18P3PH08	Quantum mechanics –II
9.	18P3PH09	Microprocessor and Microcontroller
10.	18P4PH10	Nuclear and Particle Physics
11.	1842PH11	Communication System

LIST OF ELECTIVES

S.No	Code	Course Title
1	18P1PHE01	Nano Science
2	18P2PHE02	Crystal Physics
3	18P4PHE03	Thin Film Technology
4	18P2PHE04	Bio Physics
5	18P2PHE05	Non Linear Dynamics
6	18P4PHE06	Sensors and Actuators
7	18P2PHE07	Medical Physics

LIST OF EXTRA DISCIPLINARY COURSE

S.No	Code	Course Title
1.	18P3PHED1	Solar Energy
2.	18P3PHED2	Electronics Appliances

SCHEME OF CURRICULUM – M.Sc., PHYSICS

(For the candidates admitted during the academic year 2018 - 2019 onwards)

Sem	Subject Code	Course	Subject Title	Hrs/ week	Credit	Exam Hrs	Int. marks	Ext. marks	Tot. marks
I	18P1PH01	Core – I	Mathematical Physics	6	5	3	25	75	100
	18P1PH02	Core – II	Classical and Statistical Mechanics	6	5	3	25	75	100
	18P1PH03	Core – III	Advanced Electronics	6	4	3	25	75	100
	18P1PHE01	Elective – I	Elective – I: Nano Science	4	4	3	25	75	100
	18P2PHP01	Core Practical	Practical – I: Advanced Electronics Experiments	4	-	4	-	-	-
	18P2PHP02	Core Practical	Practical - II – Advanced Physics Experiments - I	4	-	4	-	-	-
			Total	30	18	20	100	300	400
II	18P2PH04	Core-IV	Electromagnetic Theory	6	5	3	25	75	100
	18P2PH05	Core-V	Quantum Mechanics - I	6	5	3	25	75	100
	18P2PH06	Core-VI	Spectroscopy	6	5	3	25	75	100
	18P2PHE02	Elective-II	Elective – II: Bio Physics	4	4	3	25	75	100
	18P2PHP01	Core Practical-I	Practical - I: Advanced Electronics Experiments	4	4	4	40	60	100
	18P2PHP02	Core Practical-II	Practical - II: Advanced Physics Experiments - I	4	4	4	40	60	100
			Total	30	27	20	180	420	600
III	18P3PH07	Core-VII	Condensed Matter Physics	5	5	3	25	75	100
	18P3PH08	Core-VIII	Quantum Mechanics - II	6	5	3	25	75	100
	18P3PH09	Core-IX	Microprocessor and Microcontroller	5	5	3	25	75	100
	18P3CHED1	EDC	Applied Polymer Chemistry	4	4	3	25	75	100
	18P4PHP03	Core Practical -III	Practical - III: Microprocessor Experiments	4	-	4	-	-	-
	18P4PHP04	Core Practical -IV	Practical – IV: Advanced Physics Experiments - II	4	-	4	-	-	-
	18P3HR01		Human Rights	2	2	3	25	75	100
			Total	30	21	23	125	375	500
IV	18P4PH10	Core – X	Nuclear and Particle Physics	5	5	3	25	75	100
	18P4PH11	Core - XI	Communication Systems	5	5	3	25	75	100
	18P4PHE03	Elective - III	Elective – III: Thin Film Technology	4	4	3	25	75	100
	18P4PHP03	Core Practical	Practical - III: Microprocessor Experiments	4	4	4	40	60	100
	18P4PHP04	Core Practical	Practical - IV: Advanced Physics Experiments - II	4	4	4	40	60	100
	18P4PHPR01	Core - XI	Project Work	8	8	3	50	150	200
			Total	30	30	20	205	495	700
Overall Total (I & II Year)				**120**	**96**	**83**	**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	5	990	54
I	**Core practical**	4	15	60	4	4	240	16
II	**Elective**	4	15	60	3	4	180	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								**96**

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**						
Programme	**M.Sc.,**	Programme Code	**PPH**		Regulations		**2018-2019**
Department	**Physics**		Semester				**I**
Course Code	Course Name		Periods per Week		Credit	Maximum Marks	
			L	T P	C	CA	ESE Total
18P1PH01	**MATHEMATICAL PHYSICS**		5	1 0	5	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.						

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 the different kinds of non familiar problem and apply in real life situation.
PO 5	Ability to evaluate the reliability and relevance of evidence identify logical flaws and holes in the arguments of others.
PO 6	A sense of inquiry and capability for asking appropriate questions, problematising, synthesizing and articulating.
PO 7	Ability to work effectively and respectfully with diverse teams.
PO 8	Ability to analyse, interpret and draw conclusions from quantitative data and critically evaluate ideas, Evidence and experiences.
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, identify appropriate resources required for a project and manage a project through to completion.
PO 12	Possess knowledge of the values and beliefs of multiple cultures and a global perspective.
PO 13	Ability to embrace moral values in conducting oneâ€™s life formulates a position about an ethical issue from multiple perspectives.
PO 14	Capability for mapping out the tasks of a team or an organization.
PO 15	Ability to acquire knowledge and skills, personal development, meeting economic, social and cultural objectives

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 prabability
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
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	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	PO7	PO 8	PO 9	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 Vector and Matrices Analysis	Periods	12
	Functions of complex variable Elements of 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 algebra and vector calculus-Linear algebra- Linear vector spaces. Characteristic equation of a matrix, Eigen values and Eigen vectors, Cayley - Hamilton theorem.		
Unit - II	**Vectors, Tensors and Matrices** Numerical computational Technique	Periods	12
	Linear vector spaces - Subspaces - Linear independents and orthogonality of vectors - Hilberts space - Transformation of coordinates - Summation convention, Contravariant, Covariant and mixed tensors, Rank of tensor, Kronecker delta, Symmetric and Antisymmetric tensors, Contraction of tensor - Characteristic equation of a matrix - Eigen values and Eigen vectors - Cayley - Hamilton theorem- Reduction of a matrixto diagonal form - Jacobi method - Sylvester's Theorem. Elementary probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem. Elements of computational techniques: root of functions, interpolation, extrapolation, integration by trapezoid and Simpson's rule, Solution of first order differential equation using RungeKutta method. Finite difference methods.		
Unit -III	**Fourier Transforms and Laplace Transforms**	Periods	12
	Fourier series: Dirichlet'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 - Fourierâ€™s sine and cosine transform of derivative - **Complex representation of Fourier series - Fourierâ€™s integral - Different forms of Fourier integrals** - Application of Fourier Transformation in Interferometer. **Laplace Transform**: Properties of Laplace transform - **Laplace transform of derivative function - Laplace transform of integrals - Laplace transform of periodic function** - Inverse Laplace transform - Properties of inverse Laplace transform-**Laplace transform of some special functions- Evaluation of integral using InverseLaplace Transform - Applications of Laplace Transform**- solving equations for LCR circuit		
Unit-IV	Special Functions and Differential Equations	Periods	12
	Beta function - **Symmetry** property of beta function - Evaluation of beta function -**Transformation of beta function - Different forms of beta function**- Evaluation of gamma function - **Transformation of Gamma function - Reduction of definite integrals to gamma function** - Relation between Beta and Gamma functions **- Dirac delta function.** 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
	Basic Definition - Multiplication Table - Sub groups - Cosets and Classes, **Direct Product groups - Point group, Space groups, Rotation groups - Symmetry elements and symmetry operations - Representation theory - Homomorphism and Isomorphism - Reducible and Irreducible representation - Schurs Lemma- The great Orthogonality theorem** - Character Table - **C2V and C3V as examples, Treatment ofmolecular structure**. SU(2) Laplace, wave and heat equations in two and three dimensions- Contravariant, Covariant and mixed tensors, Rank of tensor, Kronecker delta, Symmetric and Antisymmetric tensors		
Total Periods			60

Text Books	
1	1. Mathematical Physics, B.D. Gupta, Vikas Publishing House, (2004).
2	2. Mathematical Physics, Satyaprakash, Sultan Chand and Sons, (2004).
References	
1	1. Mathematical Physics, P.K. Chattopadhyay, Wiley Eastern India, (1990).
2	2. Chemical applications of group theory, F.A. Cotton, Wiley Eastern India, (2001).
3	3. Elements of group theory for physicist, A.W Joshi, New age international Publishers, (2002).
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

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**						
Programme	**M.Sc.,**	Programme Code	**PPH**		Regulations		**2018-2019**
Department	**Physics**		Semester				**1**
Course Code	Course Name		Periods per Week		Credit	Maximum Marks	
			L	T P	C	CA ESE	Total
18P1PH02	**CLASSICAL ANDSTATISTICAL MECHANICS**		6	0 0	5	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 , analyse and synthesise 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, analyse, interpret and draw conclusions from data, predict cause-and-effect relationships and ability to plan, execute and report the results ofan 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 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 behaviour 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 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	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	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 3. End Semester Examinations
Indirect
1. Course End Delivery

Content of the Syllabus			
Unit - I	Fundamental Principles and Lagrangian Formulation	Periods	12
	Mechanics of a system of particles - Conservation laws and Theorems - Constraints, Generalized coordinates – D'Alembert's principle –Lagranges equation of motion from D'Alembert's principle- Procedure for formation of Lagrange's equation - Application of Lagranges formulation : Linear Harmonic oscillator - Simple pendulum –Atwood's machine – Particle moving on the surface of earth (OR) Charged particle moving in an Electromagnetic field- Hamiltons principle - Derivation ofLagranges equation of motion from Hamiltons principle - Conservation theorems and Symmetry properties.		
Unit - II	Hamiltons Formulationof Mechanics	Periods	12
	Hamiltons Canonical equations of motion - Physical Significance of H –Deduction of Hamiltion's equation from modified Hamiltion's principle–(OR) Hamiltons Canonical equations from variation principle - Principle of least action –Jacobi's form of the principle of least action - Canonical transformations - Hamilton - Jacobi method - Harmonic oscillator problem using Hamiltonian Jacobi method -Poisson brackets and Lagrang's brackets - Properties.		
Unit - III	Rigid Body Motion(OR) Dynamics of a Rigid Bodyand Special theory of relativity	Periods	12
	Generalized co-ordinates for Rigid Body Motion – Body and Space reference system–Euler's theorem Euler Angles –Components ofAngular Velocity - Angular Momentum of a rigid body :Moments and Products of Inertia –Moment of inertia of a rigid body - Eulers equation of motion - Motion of symmetrical top. Relativistic Approach Lorentz transformation - Kinematic effects of Lorentz transformation - Mass energy equivalence - Lagrangian formulation of Relativistic mechanics -Hamiltonian Formulation of Relativistic mechanics.		
Unit - IV	Classical Statistics	Periods	12
	Phase Space - Ensemble - Definition of Micro Canonical - Canonical and Grand Canonical ensembles - Liouvilles theorem - Microstates and Macro states - Sterlings formula, Entropy in statistical mechanics - Partition function - Doppler broadening of spectral lines - Principle of equipartition of energy - connection between Partition function and thermodynamically quantities.		
Unit - V	Quantum Statistics	Periods	12
	Identical particles and Symmetry requirements - Maxwell - Boltzman Statistics, 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

Text Books	
1	Classical Mechanics, Gupta, Kumar and Sharma,PragatiPrakashnan, Meerut, (2011).
2	Classical Mechanics, J.C. Upadyaya, Himalaya Publishing House, (2014).
3	Statistical Mechanics, Gupta and Kumar, PragatiPrakashnan, Meerut, (2005).
References	
1	Classical Mechanics, H. Goldstein, Narosa Publishing House, New Delhi, (2005)
2	Classical Mechanics, C.R.Mondal, Prentice - Hall of India, New Delhi, (2008).
E-References	
1	https://www.britannica.com/science/classical-mechanics
2	https://www.chegg.com/homework-help/definitions/classical-Mechanics-II.

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**						
Programme	**M.Sc.,**	Programme Code	**PPH**		Regulations		**2018-2019**
Department	**Physics**		Semester				**1**
Course Code	Course Name		Periods per Week		Credit	Maximum Marks	
			L	T P	C	CA	ESE Total
18P1PH03	**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 , analyse and synthesise 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, analyse, interpret and draw conclusions from data, predict cause-and-effect relationships and ability to plan, execute and report the results ofan 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 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 behaviour 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 informationâ€™s 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 ICâ€™s.
CO 5	To acquire Knowledge the memory devices and apply in opto electronic 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)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	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 **- Electrical Parameters.**		
Unit - II	Analog Computation and Waveform Generators	Periods	12
	Basic Op-amp Applications - **Sample and hold circuits, Logarithmic amplifiers, Antilogarithmic amplifiers.** 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 Monostablemultivibrators - Triangular wave generator		
Unit - III	Filters and Data Converters	Periods	12
	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; Phase sensitive detectors (PSD)- Phase lock loop (PLL). Basic DAC techniques - Weighted resistor DAC, R-2R Ladder DAC. ADC- Counter type, Successive approximation A/D convertor, Dual - Slope ADC, DAC/ADC Specifications: **Resolution, Accuracy, Linearity and Stability.**		
	IC Fabrication	Periods	12
Unit - IV	Basic monolithic ICs - Thin film fabrication - Epitaxial growth - Masking - Etching - Impurity diffusion, fabricating monolithic resistors, Diodes, Transistors, Inductors and Capacitors. IC 555 timer - Description of the functional diagram, Mono stable multivibrator – Astable multivibrator - Bi-Stable multivibrator - Schmitt trigger.		
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 - Photo diode - Pin Diode - LCD - LDR.		
	Total Periods		60

Text Books	
1	1. Handbook of Electronics, Gupta and Kumar, PragatiPrakashnan, Meerut, (2003).
2	2. Linear Integrated Circuits, D. Roy choudry, New Age Publications, (2015).
References	
1	1. Electronic Measurement and Instrumentation, WilliamCooper, TMG Hill, (2001).
2	2. Operational Amplifier, Robert F, Pearson Hill, (2015).
E-References	
1	1. www.khanacademy.org/science/physics/electronics/operational amplifier.
2	2. www.khanacademy.org/science/physics/electronics/memory and optoelectronic devices.

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**						
Programme	**M.Sc.,**	Programme Code	**PPH**		Regulations	**2018-2019**	
Department	**Physics**		Semester			**I**	
Course Code	Course Name	Periods per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
18P1PHE01	**ELECTIVE: NANOSCIENCE**	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	Ability to evaluate the reliability and relevance of evidence , analyse and synthesise 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, 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
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 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 behaviour 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 loumninescene spectroscopy. Understand the workingprinciple 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)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	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	Basic Properties of Nanoparticles (Concept of Nanoscience)	Periods	12
	Introduction of nanoscale science – Quantum Size effect- Particle Size- **Top down and bottom up ideas** - Particles shape; Nanostructures – Zero, One, Two and Three dimensional structure;**and properties of nano-particles** - 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; **Concept of vacuum technology.**		
Unit - II	Nanofabrication **and Nan patterning**	Periods	8
	Top down and bottom up ideas - Top down approach - Sol - gel; Hydrothermal; CVD method - **Optical, X-ray,** and electron beam Lithography - Bottom up approach: PVD method; thermal Evaporation ; **Self assembled organic layers** - Microwave techniques		
	Characterization Techniques	Periods	11
Unit - III	Surface Analysis: Scanning Electron Microscope (SEM); Transmission Electron Microscope (TEM); Atomic Force Microscope (AFM); **Scanning Tunneling Microscope (STM)** Working Principle, Instrumentation and applications - Structural analysis: XRD, XRF – Optical analysis: Photoluminescence (PL) Spectroscopy – UV-vis-NIR Spectroscopy analysis. **Elemental dispersive EDAX analysis.**Thermal analysis: Differential Scanning Calorimeter (DSC), Differential Thermal Analyzer (DTA), Thermogravimetric Analysis (TGA)		
Unit - IV	Nano Systems	Periods	8
	Quantum dot - Quantum wire - Quantum Hall effect - Carbon nano structures: C_{60}; Basics of fullerenes derivatives; CNT: SWNT – MWNT; applications - Graphene nanomaterials: Polymer nanocomposites**: Tunnel diode - Molecular transistor - Single electron transistor - Spin polarized transistor- Thin film self assembly**		
Unit - V	Applications of Nanomaterial	Periods	9
	Optoelectronic properties of molecular materials - Nanotechnology devices: OLEDs, OTFTs. Bioelectronics and biosensors: Charge Transport - DNA and Protein functional systems, Electronic noses and biosensors		
Total Periods			48

Text Books	
1	. Roland Wiesendanger â€“ Scanning Probe Microscopy and Spectroscopy â€“ Methods and Applications â€“ Cambidge University Press, (1994).
2	Joel I. Gersten, Frederick W. Smith â€“ 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 Interscience, (1990).
2	Sergei N. Magonov, Myung-Hwan Whangbo; Surface Analysis with STM and 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+filetype%3Adoc
2	https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=5&cad=rja&uact=8&ved=2ahUKEwiO_cDVnvvcAhXJqY8KHTN2D_YQFjAEegQIBhAC&url=http%3A%2F%2Fwww.lehigh.edu%2F~inmatpac%2Fsyllabus%2Fs2004mat398.doc&usg=AOvVaw18OmcUT7mNM2qfDrdLTkkG

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**							
Programme	**M.Sc.,**	Programme Code	**PPH**			Regulations		**2018-2019**
Department	**Physics**		Semester					**II**
Course Code	Course Name		Periods per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
18P2PH05	QUANTUM MECHANICS - I		6	0	0	5	25	75	100
COURSE OBJECTIVES	1. To acquire knowledge of non-relativistic and relativistic quantum mechanics. 2. The ability to understand concepts and to perform calculations of scattering of particles.							
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 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.							
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 behaviour 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.							

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

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
		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	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	1	1	1	2	2	1	1	3	2	1	1	1	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

Content of the Syllabus			
Unit - I	General Formalism of Quantum Mechanics	Periods	12
	Linear vector space – Linear operator –Adjoint and Self adjoint operators- Eigenfunctionand Eigenvalue – Hermition operator for dynamical variables – Postulates of Quantum Mechanics and the Schroedinger equation -Expectation values of dynamical quantities - Probability of current density - Ehrenfest theorem –Orthonormality -Uncertainty principle - Relations - Simultaneous measurability of observables - Diracs notation – Equation of motion - **Schrodinger, Heisenberg and Dirac representation (Pictures) -** Momentum representation.		
	Angular Momentum	Periods	12
Unit - II	Orbital Angular Momentum and their properties- Spin Angular Momentum - Total Angular Momentum Operators - Commutation relations of Total Angular Momentum with Components - Ladder operators - Commutation Relation of Jz with J+ and J-, Eigen values spectrum of J2, Jx, Jy and Jz, Matrix Representation of J2, Jz, J+ and J-, Addition of angular momenta: Clebsch Gordon Coefficients - Selection rules - Properties and its Evaluation.		
	xxxxxx	Periods	12
Unit - III	**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:** Dual Space, HibertSpace, Projection Operator, Unit Operator, Unitary Operatorand Matrix Theory of Harmonic Oscillator		
Unit - IV	Approximation Methods	Periods	12
	Equation in various orders of time dependent perturbation theory – the non-degenerate case : the First order – the second order – Selection rule - The degenerate case – Removal of Degeneracy - Ground State of Helium Atom - Application to ground state of anharmonic oscillator and Stark Effect in Hydrogen - Spin - Orbit interaction - Variation Method & its application to Hydrogen Molecule - WKB Approximation Time Independent Perturbation Theory in Non - Degenerate Case, Ground State of Helium Atom,Degeneracy - 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 anElectromagnetic Field.		
Total Periods			60

Text Books		
1	Quantum Mechanics â€“ Theory and Problems by S. L. Kakani and H.M. Chandalia, Sultan Chand & Sons,(2007).	
2	Advanced Quantum Mechanics, Satya Prakash, KedarNath Ram Nath Publications, (2013).	
3	Quantum Mechanics, Claude, Frank and Bernard, John Wiley Inter science, (2003).	
References		
1	1. A text book of Quantum Mechanics, Mathews and Venkatesan, TMG Hill, (2002).	
2	2. Quantum Mechanics, Jasprit Singh, John Wiley Interscience, (2005).	
E-References		
1	http://alan.ece.gatech.edu/ECE6451/Lectures/ECE6451L4PostulatesOfQMAndOperatorsVer2.pdf	
2	ttps://www.phas.ubc.ca/~mcmillan/rqpdfs/5_qm_in_one_dimension.pdf	

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**							
Programme	**M.Sc.,**	Programme Code	**PPH**			Regulations		**2018-2019**
Department	**Physics**		Semester					**II**
Course Code	Course Name		Periods per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
18P2PH06	**SPECTROSCOPY**		6	0	0	5	25	75	100
COURSE OBJECTIVES	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 , 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 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.							
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 behaviour 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 membersto 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)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PO1 3	PO1 4	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 – Hydrogen atom spectrum – Electron spin – Stern-Gerlach experiment – Zeeman effect – Stark effect. 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), **Classical theory of Raman Effect, Pure Rotational Raman Spectra (Linear and Symmetric top molecules), Stark effect –** Microwave Spectrometer.		
Unit - II	IR 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, Breakdown of Born - Oppenheimer Approximation, Influence of rotation on the spectra of polyatomic molecules (Linear and Symmetric top Molecules). Raman Spectroscopy: Raman Effect, Classical and Quantum Theory of Raman Effect, Pure Rotational Raman Spectra (Linear and Symmetric top molecule**s),** 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 – **Zeeman Effect**.		
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. **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	**2018-2019**
Department	**Physics**		Semester		**II**

Course Code	Course Name	Periods per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
18P2PHE02	**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 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.
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 behaviour 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 membersto 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)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PO1 3	PO1 4	PO1 5
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 - electronegativity - 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
	Biomolecules 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.		
	Instrumentation	Periods	12
Unit - V	Control of movement Primary of movement-Ballistic control in a simplified visual system-more sophisticated-mode of control-structure of muscle fibres-central pattern generators-conditioned reflexes-volition-and Free will-consciousness Passive verses active in mental processing.		
	Total Periods		40

Text Books	
1	RodyneyM.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

Signature of BOS Chairman

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)

Elayampalayam, Tiruchengode-637 205.

Programme	**M.Sc.,**	Programme Code	**PPH**	Regulations	**2018-2019**
Department	**Physics**		Semester		**II**

Course Code	Course Name	Periods per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
18P2PH04	**ELECTROMAGNETIC THEORY**	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 the research 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 ,analyse and synthesise data from a variety of sources then draw valid conclusions and support them with evidence and examples, and addressingopposing viewpoints.
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
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 use appropriate software for analysis of data
PO 11	Ability to work independently, identify appropriate resources required for a project, and manage a projectthrough 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)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	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 infront of a conducting sphere - Multipole expansion - Electrostatic energy - Dielectrics - Polarization and Displacement vectors, Boundary conditions - Dielectric sphere in a uniform field - Molecular polarizabilityand Electrical susceptibility - **Electrostatic energy in dielectric medium** - 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 - Maxwells equation in free space and isotropic media - Maxwells 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 – Conservationlaws for a 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, Inhomogeneous wave Equation and Retarded potentials, Field and Radiation due to an oscillating electric dipole.		
Unit - V	Plasma Physics	Periods	12
	Plasma - Debye length - Plasma oscillations - Plasma behaviour 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 – Dynamicsof charged particle in uniform electromagnetic fields - Plasma arc welding technique.		
	Total Periods		60

Text Books	
1	1. Introduction to Electrodynamics, Griffith, Prentice Hall of India, (2015).
2	2. Electromagnetic Waves and Fields, Paul Corson and Dale, CBS Publishers, (2005).
References	
1	1. Basic Electromagnetics with Application, N. Narayana, Prentice Hall of India, (2001).
2	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		**2018-2019**
Department	**Physics**		Semester				**III**
Course Code	Course Name		Periods per Week		Credit	Maximum Marks	
			L	T P	C	CA	ESE Total
18P3PH07	**CONDENSED MATTER PHYSICS**		5	0 0	5	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 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 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 or committing plagiarism, notadhering 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 membersto 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	PO7	PO 8	PO 9	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	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	Electron Energy Bands	Periods	14
	Fundamentals of crystailline states- Bravais lattice- Miller indices –Simple crytal structure-Basic concepts of energy bands - Fermi surface - Density of states - The Blochs Theorm - Kronig Penney model - Zone schemes for energy bands - Brillouin zones - 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 - Escape of electrons from metal - Potential energy of an electron outside the metal.		
Unit - III	Diamagnetism, Paramagnetism and Ferromagnetism	Periods	12
	Diamagnetism -Langevin classical theory of Diamagnetism -Paramagnetism - Weiss theory of paramagnetism -Quantum theory of Paramagnetism – Adiabatic demagnetization-Demagnetization of a paramagnetyic salt - Determination of susceptibility of para and diamagnetism using Guoys method - Ferromagnetism - Spontaneous magnetization in ferromagnetic materials - Quantum theory of ferromagnetism - Curie – Weisslaw - Weiss molecular field – Domain theory-Ferromagnetic domains - Antiferromagnetism - Ferrimagnetism		
Unit - IV	Superconductivity	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 - Josephson tunneling effect - DC and AC Josephson effect Power Applications of superconductors - High temperature Superconductors - High temperature Ceramic Superconductors- Potential application of super conductivity.		
Unit - V	Semiconductor Devices	Periods	10
	Introduction to semiconductors-Hall effect in semi conductors - Vacuum level and Work function of metals - Solar cells, Qualitative ideas of MEMs, Spintronics, Quantum Dots (QDs) & Molecular Electronics - LED and Photodiode,Pindiode,Schottky diode.		
	Total Periods		60

Text Books	
1	Solid State Physics - S.O. Pillai, New Age Publication, 2nd Edition, 2002.
2	Solid State Physics â€“ 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 â€“ 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	**2018-2019**	
Department	**Physics**		Semester				**III**	
Course Code	Course Name		Periods per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
18P3PH08	**QUANTUM MECHANICS - II**		6	0	0	5	25	75	100
COURSE OBJECTIVES	1.To acquire knowledge of non-relativistic and relativistic quantum mechanics. 2.The ability to understand concepts and to perform calculations of scattering of particles.							
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 synthesise 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 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 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 behaviour 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 membersto 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)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	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 2. Assignment 3. End Semester Examinations
Indirect
1. Course End Delivery

Content of the Syllabus			
Unit - I	Semi classical Theory of Radiation	Periods	12
	Emission & Absorption of radiation - Electric dipole approximation -Einstein's Transition probabilities and A & B Coefficients - Selection rules -Quantization of radiation field - Interaction with matter - Spontaneous & Stimulated emissions Quantum theory of Valence Bond VB method - Hitler - London theory of Hydrogenmolecule in VB method - Refinements of Simple MO and VB approximations.		
Unit - II	Scattering Theory	Periods	12
	Scattering cross section-Scattering amplitude - Greens function - Partial wave analysis - Phase shifts - The scattering amplitude in terms of phase shift -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 - Spin functions for three electrons - Helium atom - Central field approximation - Thomas Fermi model of the atom - Hatree Equation - Hatree - FockEquation		
Unit - IV	Relativistic Wave Equation	Periods	12
	Klein - Gordan Equation - Diracs equation for a free particle - Dirac Matrics - Covariant form of dirac equation - Probability density and current density - Plane wave solution - Negative energy 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 - Anti Commutation Relations - Quantization of Electromagnetic Field		
	Total Periods		60

Text Books	
1	1. Quantum Mechanics â€“ GAruldhas - Prentice Hall of India, (2006).
2	2. Quantum Mechanics â€“ Satyaprakash - Sultan Chand Publishers, (2013).
3	3. Quantum Mechanics â€“ Gupta Kumar Sharma - JaiprakashNath Publications, Meerut, (2013).
References	
1	A text Book of Quantum Mechanics â€“ P. M.Mathews&K.Venkatesanâ€“Tata Mc Graw Hill, (2004).
2	Introduction to Quantum Mechanics â€“ David J.Griffths â€“ Pearson Prentice Hall, 2nd edition, (2009).
3	Quantum Mechanics â€“ 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/

Signature of BOS

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**							
Programme	**M.Sc.,**	Programme Code	**PPH**			Regulations		**2018-2019**
Department	**Physics**		Semester					**III**
Course Code	Course Name		Periods per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
18P3PH09	**MICROPROCESSORS AND MICROCONTROLLERS**		5	0	0	5	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 clearandconcise 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							
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, 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 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 in 8085.
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 and timers.
CO 5	To get the knowledge about architecture of 8051 and instruction set of 8051. Apply the ascending and descending order program in 8051.
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)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	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: Insertion cycle, Machine cycle -Halt state and Wait state. Interrupts: Types of interrupts - Hardware and Software interrupts-masking and unmasking interrupts.		
	MICROPROCESSORS 8085 INSTRUCTION SETS & PROGRAMMING OF MICROPROCESSOR 8085	Periods	12
Unit - II	Assembly language - Instruction sets of 8085 - Stacks - Counters - Subroutines - MACRO - Delay Subroutine - Examples of Assembly language Programming - 8bit addition - 8bit subtraction - 16 bit Addition - 16 bit Subtraction - 16 bit Multiplication - 16 bit Division - The Largest and Smallest number in a data array - Sorting - Sum of a series - Factorial of a given number		
Unit - III	**APPLICATIONS OF MICROPROCESSORS** 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. 8085A interrupt system: Software & hardware interrupts - interfacing - Working and Programming of PIC 8259 with 8085.		
Unit - IV	APPLICATIONS OF MICROPROCESSOR 8085	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.		
Unit - IV	**ARCHITECTURE OF MICROCONTROLLER 8051**	Periods	12
	Introduction - Comparison between microcontroller and microprocessors - Architecture of 8051 – Key features of 8051- Memory organization Data memory and program memory - Internal RAM organization - Special function registers - Control registers - I/O ports - Counters and Timers - Interrupt structure.		
	ARCHITECTURE AND PROGRAMMING THE MICROCONTROLLER 8051	Periods	12
Unit - V	Introduction– Comparison between microcontroller and microprocessors - Key features of 8051 - Architecture of 8051 – Instruction set of 8051 – **Arithmetic, Logical, Data move jump and call instructions - Addressing modes – Immediate, register, direct and indirect addressing modes** – Assembly language programming **– Simple programs to illustrate arithmetic and logical operations** - Sum of **'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	Kenneth J. Ayala, *The 8051 Microcontroller – Architecture, Programming & Applications*, Third Edition, West Publishing Company, New York India (2007)

References	
1	Nagoor Kani, *Microprocessors and Microcontrollers,* Second Edition, Mcgraw-Hill Education India Pvt., Ltd., New Delhi (2017
2	A.P.Godse and D.A.Godse, *Microprocessors and Microcontrollers,* Technical Publications, Pune (2015).
3	M.Gilmore, *Microprocessor Principles and Applications*, Second Edition, **Mcgraw-Hill Education India Pvt., Ltd., New Delhi** (1995).
4	Aditya P.Mathur, Introduction to Microprocessors, Third Edition**, Mcgraw-Hill Education India Pvt., Ltd., New Delhi** (2006).
E-References	
1	https://onlinecourses.nptel.ac.in/noc18_ec03
2	https://www.elprocus.com/microprocessor-and-microcontroller/

Signature of BOS Chairman

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)

Elayampalayam, Tiruchengode-637 205.

Programme	**M.Sc.,**	Programme Code	**PPH**	Regulations	**2018-2019**
Department	**Physics**		Semester		**III**

Course Code	Course Name	Periods per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
18P3PHED1	**EDC : SOLAR ENERGY**	4	0	0	4	25	75	100

COURSE	1.Energy resources around us. 2.Threatening to our energy resources. 3. How to conserve energy.
OBJECTIVES 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 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.
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 behaviour 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	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)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	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 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 (basicideas) - Merits and Demerits.		
Unit - II	Solar Thermal Energy	Periods	9
	Renewable energy sources - Solar energy - Solar water heater - Solar space heating and cooling - Solar thermal technologies - Solar cooker - Solar Pond - Merits and Demerits of solar energy-Solar pumping,Solar furnace.		
Unit - III	Solar Cell	Periods	9
	Photo voltaic effect - Performance of solar cell Solar cell parameter-Solar cell parameters-Solar cell characterstics and efficiency-Single crystal silicon solar cell- Choice of materials for solar cell - Basic requirements forobtaining an effective solar cell - Power generation by using solar cell.		
Unit - IV	Biomass Energy Fundamentals	Periods	9
	Biomass energy - Classification - Photosynthesis - Biomass conversion technology –Wet and dry process-Biogas generation-Introduction basic process and energetic, Advantages-Advantages and Disadvantages of biomass energy.		
Unit - V	Energy Storge	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

Signature of BOS Chairman

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)

Elayampalayam, Tiruchengode-637 205.

Programme	**M.Sc.,**	Programme Code	**PPH**	Regulations	**2018-2019**
Department	**Physics**		Semester		**IV**

Course Code	Course Name	Periods per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
18P4PH10	**NUCLEAR AND PARTICLE PHYSICS**	6	0	0	5	25	75	100

COURSE OBJECTIVES	1.Explain central concepts, laws and models in 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 clearandconcise 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,analyse, 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 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 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 behaviour 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 Gamows 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, 1-weak)

COs	Programme Outcome (POs)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PO1 3	PO1 4	PO1 5
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 MODELS** NUCLEAR PROPERTIES AND MODELS	Periods	12
	Basic nuclear properties: Size, shape and charge distribution-spin and parity-determination of nuclear mass-binding energy-semi empirical mass formula-nuclear stability-Mass Parabola-Liquid drop model-Shell Model-Prediction of Magic numbers and energy levels by shell model-Optical Model - Collective model of Bohrand Mottelson.		
Unit - II	NUCLEAR REACTIONS	Periods	12
	Nuclear reactions and reaction mechanism, Types of reactions and conservation laws – Reciprocity theorem- Energetics 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-Wignerone level formula- continuum theory of nuclear reaction.		
Unit - III	NUCLEAR INTERACTIONS	Periods	12
	Nature of Nuclear forces-Exchange forces-Two body problem-ground state of deuteron- Magnetic moment-Quardrapole moment-Tensor forces-Nucleon-nucleon interaction-NP scattering, PP scattering at low energy, non- central-Meson theory of nuclear forces -Yukawa potential-Nucleon-Nucleon scattering- form of nucleon-Nucleon potential-Effective range theory-Spin dependence of nuclear forces-Chargeindependence and charge symmetry of nuclear forces - Isospin formalism.		
Unit - IV	NUCLEAR DECAY	Periods	12
	Gamows theory of alpha decay &Fermis theory of beta dacay -Total decay rate-Mass of the neutrino-Angular momentum and parity selection rules-Allowed and forbidden decays – Comparativehalf-lives-**Neutrino physics** Neutrino Hypothesis-Helicity-Non-conservation of parity-Multipole transitionsin nuclei-**Angular momentum and parity selection rules**-Internal conversion-Nuclear isomerism		
Unit - V	ELEMENTARY 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- Gellman-nishijima formula-SU(2) and SU(3) multiplets-Gell-Mann-Okubo mass formula for octet and decuplet-Quark model-color flavor**- weak and strong interactions**- Basic concepts of relative kinematics.		
Total Periods			60

Text Books	
1	D. Griffiths, Introduction to Elementary Particle Physics, Harper & Row, New York, (2006).
2	R. R. Roy and B.P. Nigam, Nuclear Physics, New age Intl. New Delhi, (2005).
References	
1	H. A. Enge, Introduction to Nuclear Physics, Addison-Wesley, Tokyo, (2006).
2	Y. R. Waghmare, Introductory Nuclear, Physics, Oxford-IBH, New Delhi, (2006).
E-References	
1	https://onlinecourses.nptel.ac.in/noc18_ph02/course
2	https://en.wikipedia.org/wiki/Particle_physics

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**							
Programme	**M.Sc.,**	Programme Code	**PPH**			Regulations	**2018-2019**	
Department	**Physics**		Semester				**IV**	
Course Code	Course Name		**Periods per Week**			**Credit**	**Maximum Marks**	
			L	T	P	C	CA	ESE	Total
18P4PH11	COMMUNICATION SYSTEMS		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, 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 behaviour 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)

COs	Programme Outcome (POs)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	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	1	1	1	2	2	1	1	3	2	1	1	1	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	**MODULATION SYSTEMS**	Periods	12
	Theory of Amplitude modulation - Theory of frequency modulation - Theory of phase modulation - Pulse code modulation - Pulse width modulation - Sampling theorem - low pass and band pass signals, PAM, **Channel BW for a PAM signal, Natural Sampling, Flat top Sampling, Signal recovery through holding, Quantization of signals,** Differential PCM delta modulation - Delta modulation - Adaptive Delta modulation - BPSK, QPSK.		
Unit - II	**FIBER OPTICS COMMUNICATION**	Periods	12
	Basics of Fiber Optics – Classification - Single mode and multimode, Step index and Graded index. Acceptance angle, Numerical Aperture, Fiber Losses - Attenuation, Absorption, Leaky modes, Bending losses, Transmission losses, and Core and cladding losses - Chromatic and modal dispersion. **Splicing and connectors.**		
Unit - III	**MICROWAVE COMMUNICATION SYSTEM**	Periods	12
	Microwave Generation - Multicavity Klystron - Reflex Klystron - Magnetron - Travelling Wave Tubes (TWT) - **Propagation modes,** 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 - **Multiple Accessing Frequency Hopping,** Channel Capacity – RADAR.		
Unit - V	**MOBILE COMMUNICATION**	Periods	12
	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 **- DIGITAL Cellular Radio.**		
Total Periods			60

Text Books	
1	1. Electronic Communication Systems â€“George Kennedy& Davis, Tata McGraw Hill, 4th Edition, (2006).
2	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 Mc Graw 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.

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**						
Programme	**M.Sc.,**	Programme Code	**PPH**		Regulations		**2018-2019**
Department	**Physics**		Semester				**IV**
Course Code	Course Name	Periods per Week			Credit	Maximum Marks	
		L	T	P	C	CA	ESE	Total
18P4PHE03	ELECTIVE: THIN FILM TECHNOLOGY	4	0	0	4	25	75	100
COURSE OBJECTIVES	To examine the electrical properties in metallic thin films. To explore the transport properties of semi conducting and insulating film. To know how the optical properties of thin film is utilized in solar cell 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 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 synthesise 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, analyse, 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 workefficiently as a member of a team							
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 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 or committing plagiarism, notadhering 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	Analyse 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
Pre-requisites	To 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
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)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PO1 3	PO1 4	PO1 5
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
CO4	2	3	3	2	1	2	1	2	2	2	2	2	2	2	2
CO5	1	1	1	1	2	1	1	1	1	1	1	1	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	Preparation of Thin Films	Periods	12
	Basics of thin film - Nucleation and growth of thin films -**four stages of film growth**. Study of thin film vacuum coating unit - **Construction and uses of vapor sources** – wire; sublimation; crucible vacuum pumps; and electron bombardment heated sources. Thin film preparation methods: Physical vapor deposition(PVD) - Thermal evaporation; electron beam evaporation; **Sputtering-Study of glow Discharge- Experimental set up for DC and RF magnetron sputtering,** Pulsed laser deposition; Ion beam assisted deposition - Chemical vapor deposition (CVD) - MOCVD and PECVD processes. Chemical methods**: Qualitative study of preparation of thin films by Electroplating**; vapor phase growth and adonization.		
Unit - II	Deposition Monitoring and Control	Periods	8
	Electrical methods:**Micro balance**, 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(qualitative only).		
Unit - III	Electrical properties	Periods	8
	Electrical conduction in thin metallic films - Resistivity of the metallic film; Sheet resistance - Hall**size** effect - Calculation of mobility - DC conduction mechanism - Low field and high field conduction. Breakdown mechanism in dielectric films-AC conduction mechanism. Temperature dependence of conductivity. Thermal treatment process: Effect of ageing and annealing; Oxidation; Agglomeration		
Unit - IV	Dielectric Properties	Periods	11
	DC conduction mechanism - Low field and high field conduction. Breakdown mechanism in dielectric films-AC conduction mechanism. Temperature dependence of conductivity. Structure and Optical Properties: Study of structure of thin films using x-ray diffraction method-Calculation of particle size-Optical constants of thin films - UV spectrophotometer- Transmittance, absorption, determination of band gap. Surface morphological properties – Scanning electron microscopy (SEM) – Transmission electron microscopy (TEM).		
Unit - V	Application of Thin Films	Periods	9
	Thin film resistors: Materials and Design of thin film resistors **Choice of resistor and shape and area**-Trimming of thin film resistors-**sheet resistance control - Individual resistor trimming**. Thin film capacitors: Materials-Capacitor structures-Capacitor yield and capacitor stability. Thin film field effect transistors: Fabrication and characteristics-Thin film solar cells - anti reflection coatings.		
	Total Periods		48

Text Books	
1	Hand book of Thin films Technology: L I Maissel and R Clang, New York: McGraw-Hill, 1970.
2	Thin film Phenomena: K.L. Chopra, NewYork: Mc Graw-Hill, 1969.
3	Thin films processes â€“ J.L.Vilsan,1993.
References	
1	Physics of thin films, Vol. 12, First Edition Georg Hass Maurice H. Francombe John L. Vossen.
2	Thin films solar cells â€“K.L. Chopra and S. R. Das, 1983.
3	Vacuum deposition of thin films â€“ L.Holland , 1956.
E-References	
1	https://www.tno.nl/en/focus-areas/industry/expertise-groups/thin-film- technology/

Signature of BOS Chairman

	VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) **Elayampalayam, Tiruchengode-637 205.**							
Programme	**M.Sc.,**	Programme Code	**PPH**			Regulations	**2018-2019**	
Department	**Physics**		Semester				**IV**	
Course Code	Course Name		Periods per Week			Credit	Maximum Marks	
			L	T	P	C	CA	ESE	Total
18P4PHE07	ELECTIVE: MEDICAL PHYSICS		4	0	0	4	25	75	100
COURSE OBJECTIVES	To examine the particle accelerators. To explore the construction of X-ray generator used in Diagnostic radiology. To know about the radioisotopes, 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 analyse, interpret and draw conclusions from quantitative/qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective							
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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.							
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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, notadhering 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)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	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
CO4	2	3	3	2	1	2	1	2	2	2	2	2	2	2	2
CO5	1	1	1	1	2	1	1	1	1	1	1	1	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	X-ray Generators	Periods	12
	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 –Design requirements for x-ray equipment, Faults detection in X-ray equipment such as pitting of anode, filament evaporation etc., - Types of x-ray units (Fixed radiography, CT, Interventional radiology, C-Arm, Mammography, Bone Mineral Densitometer, dental X-ray units etc.,).		
Unit - II	Particle Accelerators	Periods	8
	Particle accelerators for industrial, medical and research applications - The Resonant transformer Cascade generator - Van De Graff Generator - Pelletron - Betatron - Synchro-Cyclotron- Linear Accelerator - Klystron and magnetron - Travelling and Standing Wave Acceleration - Microtron - Electron Synchrotron-Proton synchrotron- Hadron (proton/carbon ion) accelerators. Working principle of Cyclotron and charged particle accelerators, Applications of cyclotrons in medicine, Types of Cyclotrons: self-shielded and unshielded (in-bunker) and locally shielded. Beam transport systems - Beam delivery systems- Energy slits – degrader - Ridge filter - Range Shifter - Uniform and Pencil beam scanning systems-beam dump- Auxiliary equipment and their safety significance: vacuum pumps, RF-power, magnet power supply; cooling system, control software and programs used for medical cyclotron operation.		
Unit - III	Radiation Sources and their Medical Applications	Periods	8
	Radiation sources - Natural and artificial radioactive sources - Large scale production of isotopes Reactor produced isotopes (60 Co, 192 Ir, 99 Mo etc.,) - Cyclotron produced isotopes (18 F, 13 N, 15 O, 11 C)- Fission products (137 Cs, 99 Mo, 131 I, 90 Sr) –Teletherapy sources– Requirement for brachytherapy sources - Description of radium and radium substitutes - 137 Cs, 60 Co, 192 Ir, 125 I and other commonly used brachytherapy sources. Beta ray applicators – ophthalmic applicators (90 Sr, 125 I, 106 Ru etc.,) Thermal and fast neutron sources (241 Am-Be, 252 Cf etc.,).		
Unit - IV	Lasers in Medicine	Periods	11
	Lasers in medicine-applications of Ultrafast pulsed Lasers -Lasers in dermatology, oncology and cell biology - Lasers in blood flow measurement - Fiber optics 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.