VIVEKANANDHA

COLLEGE OF ARTS AND SCIENCES FOR WOMEN

(AUTONOMOUS)

An ISO 9001: 2008 Certified Institution

(Approved by AICTE, Affiliated to Periyar University and Re-accredited with A grade by NAAC, Recognized under section 2(f) and 12(B) of UGC Act,1956)

Elayampalayam, Tiruchengode - 637 205

PG AND RESEARCH DEPARTMENT OF PHYSICS

M.Sc., DEGREE - OBE SYLLABUS

2019-2021

	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
18P1PH01	**MATHEMATICAL PHYSICS**		5	1	0	5	25	75	100
COURSE OBJECTIVES	1.To acquire knowledge of non-relativistic and relativistic quantum mechanics2.The ability to understand concepts and to perform calculations of scattering of particles.3. The ability to critically understand and evaluate modern research							
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 and evaluation of definite integrals
CO 2	To acquire knowledge of vector tensor and matrices. Understand the characteristic equation of matrix and evaluate Hamiltonian theorem
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
CO 5	To acquire the knowledge of group theory. Understand Reducible and irreducible representation. Evaluate C2V and C3V point groups.
Pre-requisites	To gain 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	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 Analysis	Periods	10
	Functions of complex variable - Cauchy-Riemann condition, Differential equation - Cauchy integral theorem - Cauchy integral formulas-Taylors Series- Laurent's Series - Residue theorem - Evaluation of definite integrals - Contour integration.		
Unit - II	Vectors, Tensors and Matrices	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.		
Unit - III	Fourier Transforms and Laplace Transforms	Periods	14
	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.		
Unit - IV	Special Functions and Differential Equations	Periods	14
	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. Solution for Bessel, Legendre, Lagure and Hermite differential equations -Properties - Generating functions, Rodrigues formula, Orthogonal properties, Recurrence relation.		
Unit - V	Group Theory	Periods	10
	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.		
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 AND STATISTICAL 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 behavior such as fabrication, falsification or misrepresentation of data							
PO 14	Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision.							
PO 15	Ability to acquire knowledge and skills, including how to learn, that are necessary for participating in learning activities throughout life.							

COs	COURSE OUTCOME
CO 1	To 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)														
	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	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 - Constraints, Generalized coordinates - D-Alemberts principle - Lagranges equation of motion from D-Alemberts principle- Application of Lagranges formulation - Linear Harmonic oscillator - Simple pendulum - Hamiltons principle - Derivation ofLagranges equation of motion from Hamiltons principle - Conservation theorems and Symmetry properties.		
	Hamiltons Formulation	Periods	12
Unit - II	Hamiltons Canonical equations of motion - Physical Significance of H - Hamiltons Canonical equations from variation principle - Principle of least action - Canonical transformations - Poisson brackets - Properties - Hamilton - Jacobi method - Harmonic oscillator problem using Hamiltonian Jacobi method - Lagrangs brackets - Properties.		
Unit - III	Rigid Body Motion	Periods	12
	Generalized coordinates for Rigid Body Motion - Euler Angles - Eulerian theorem - Angular Velocity - Angular Momentum of a rigid body - Motion of symmetrical top - Moments and Products of Inertia - Eulers equation of motion 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 – connectionbetween 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 and Kumar, PragatiPrakashnan, Meerut, (2005).
2	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 - 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.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 - Astablemultivibrator - 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		**1**

Course Code	Course Name	Periods per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
18P1PHE01	**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	Periods	12
	Particle Size: Top down and bottom up ideas - particles shape - Size effect and properties of nano-particles; Particle density; Melting point; Surface tension; Wettability; Specific surface area and pore; Composite structure; Crystal structure; Surface characteristics; Mechanical properties; Electrical properties; Magnetic properties; Optical properties; Concept of vacuum technology		
Unit - II	Nanofabrication and Nan patterning	Periods	8
	Sol - gel Synthesis - Hydrothermal Synthesis - CVD method - Optical, X-ray, and electron beam lithography - Self - assembled organic layers - Microwave techniques		
Unit - III	Characterization Techniques	Periods	11
	Scanning Electron Microscope (SEM) - Transmission Electron Microscope (TEM) -Atomic Force Microscope (AFM) - Scanning Tunneling Microscope (STM), XRD - Working Principle, Instrumentation and applications - Photoluminescence (PL) Spectroscopy - UV Spectroscopy analysis - Elemental dispersive EDAX analysis.		
Unit - IV	Nano Systems	Periods	8
	Quantum dot - Quantum wire - Quantum Hall effect - C60- Basics of fullerences - Carbon nano - tubes and its applications - 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		**2**

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 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 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
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	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)														
	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	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

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	General Formalism of Quantum Mechanics	Periods	12
	Expectation values of dynamical quantities - Probability of current density - Ehrenfest theorem - Uncertainty principle - Relations - Simultaneous measurability of observables - Diracs notation, Schrodinger, Heisenberg and Dirac representation (Pictures) - Momentum representation.		
	Angular Momentum	Periods	12
Unit - II	Orbital Angular Momentum - 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 - Properties and its Evaluation.		
	operators		
Unit - III	Eigen values, Eigen vectors: Characteristic equation of a matrix, Schrodinger, Heisenberg and Interaction matrix representation. Diracs Bra and Ket vectors: Dual Space, Hibert Space, Projection Operator, and Matrix Theory of Harmonic Oscillator		
Unit - IV	Approximation Methods	Periods	12
	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 an Electromagnetic Field.		
Total Periods			60

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		**2**

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 .
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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.
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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 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	PO10	PO11	PO12	PO13	PO14	PO15
CO1	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO2	1	1	1	2	2	1	1	3	2	1	1	1	2	2	1
CO3	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO4	1	2	2	3	1	1	1	2	1	1	2	2	3	3	1
CO5	1	1	1	2	2	1	1	3	2	1	1	1	2	2	1

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

Content of the Syllabus			
Unit - I	Microwave Spectroscopy	Periods	12
	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
	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 Effect - Quantum Theory of Raman Effect - Selection Rules - Degree ofdepolarization - 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 & 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: Fundamental requirements - General Principle - Experimental detection of NQR frequencies - Interpretation and Chemical explanation of NQR Spectroscopy.		
	ESR &Mossbauer Spectroscopy	Periods	12
Unit - V	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	Vibrational Spectroscopy, Sathyanarayana, New Age International Publications, (2004).
2	Fundamentals of Molecular Spectroscopy, Banwell, TMG Hill, (2009).
References	
1	Spectroscopy II, Straughan and Walkar, Chapman and Hall, (2003).
2	Modern Molecular Spectroscopy, Randhava, Macmillan India, (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		**2**

Course Code	Course Name	Periods per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
18P2PHE02	**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.
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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 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		**2**

Course Code	Course Name	Periods per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
18P2PHE04	**ELECTROMAGNETIC THEORY**	6	0	0	5	25	75	100

COURSE OBJECTIVES	To provide the basic skills required to understand, develop, and design Electromagnetic materials and 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 - Magnetohydrodynamic 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		**3**

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 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.
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 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
	Basic concepts of energy bands - Fermi surface - Density of states - The BlochsTheorm - 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 - 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 - 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		
Unit - V	Semiconductor Devices	Periods	10
	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		
	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

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		**3**

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.
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 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 emissionsQuantum theory of Valence BondVB 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 – Fock Equation		
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 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		**3**

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 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 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 architecture of 8051. Understand the counters and timers.
CO 5	To get the knowledge about instruction set of 8051. Apply the ascending and descending order program in 8085.
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 MICROPROCESSORS8085**	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.		
	CROPROCESSORS 8085 INSTRUCTION SETS & PROGRAMMING	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	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	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.		
Unit - V	PROGRAMMING THE MICROCONTROLLER 8051	Periods	12
	Instruction set of 8051 - Arithmetic, Logical, Data move jump and call instructions - Addressing modes - Immediate, register, direct and indirect addressing modes - Assembly language programming - Simple programs to illustrate arithmetic and logical operations (Sum of numbers, biggest and smallest in an array,Ascending and descending order program in an array) - Software time delay		
Total Periods			60

Text Books	
1	Microprocessor Architecture, Programming and Applications with 8085, Ramesh S. Gaonkar, Penram International Publishing, (1997).
2	Fundamentals of Microprocessor and Microcomputers, B. Ram, V Edition, Dhanpat Rai Publications (P) Ltd. New Delhi, (2003).
References	
1	M.Gilmore, Microprocessor Principles and Application, TMH, 2nd edition, (1995).
2	Aditya P.Mathur, Introduction to Microprocessors, Tata McGraw Hill Company, III edition, (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		**3**

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 OBJECTIVES	1.Energy resources around us.2.Threatening to our energy resources.3. How to conserve energy.
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 Cell	Periods	9
Unit - III	Photo voltaic effect - Performance of solar cell - Choice of materials for solar cell - Basic requirements for obtaining an effective solar cell - Power generation by using solar cell.		
	Biomass Energy Fundamentals	Periods	9
Unit - IV	Biomass energy - Classification - Photosynthesis - Biomass conversion technology -Advantages and Disadvantages of biomass energy.		
	Energy Storge	Periods	9
Unit - V	Introduction - Liquid media storage - Solid media storage - Ground collector - Chemical storage.		
	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					**4**
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	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO2	2	3	3	2	1	2	1	1	1	2	3	3	2	2	1
CO3	3	2	2	1	1	3	1	1	1	3	2	2	1	1	1
CO4	1	1	1	1	3	1	2	2	3	1	1	1	1	1	2
CO5	1	1	1	2	2	1	1	3	2	1	1	1	2	2	1

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

Content of the Syllabus			
Unit - I	NUCLEAR MODELS	Periods	12
	Basic nuclear properties: Size, shape and charge distribution-spin and parity-determination of nuclear mass-binding energy-semi emprical mass formula-nuclear stability-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
	Nucler reactions and reaction mechanism, Types of reactions and conservation laws - 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		**4**

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	GET KNOWLEDGE ABOUT 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 andconnectors.		
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 FrequencyHopping, 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/

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		**4**

Course Code	Course Name	Periods per Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
18P4PHE03	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	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	Preparation of Thin Films	Periods	12
	Study of thin film vacuum coating unit-Construction and uses of vapour sources-wire, sublimation, crucible and electron bombardment heated sources. Physical vapour deposition- Thermal evaporation-electron beam evaporation-Sputtering-Study of glow Discharge- Experimental set up for DC and RF magnetron sputtering, Pulsed laser deposition and Ion beam assisted deposition. Chemical vapour deposition-CVD, MOCVD and PECVD processes. Chemical methods: Qualitative study of preparation of thin films by Electroplating,vapour phase growth and anodization-Nucleation and growth of thin films - four stages of film growth.		
	Deposition Monitoring and Control	Periods	8
Unit - II	Micro balance, Crystal oscillator thickness monitor, optical monitor, Resistance Monitor. Thickness measurement: Multiple Beam Interferometer, FizeauTolansky technique-Fringes of equal chromatic order FECO method-Ellipsometry qualitative only.		
Unit - III	Electrical properties	Periods	8
	Sheet resistance-size effect-Electrical conduction in thin metallic films- Calculation of mobility- Effect of ageing and annealing - Oxidation - Agglomeration		
	Dielectric Properties	Periods	11
Unit - IV	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 particlesize-Optical constants of thin films - UV spectrophotometer- Transmittance, absorption, determination ofband gap		
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/