



# VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN

[Autonomous]

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Elayampalayam – 637 205. Tiruchengode, Namakkal Dt., Tamil Nadu

VIVEKANANDHA  
EDUCATIONAL INSTITUTIONS

## 1.1 Curriculum Design and Development

### 1.1.2 Syllabus Revision

**M.Sc., - PHYSICS**

**(2020-21)**

**PG AND RESEARCH DEPARTMENT  
OF PHYSICS**

(For the candidates admitted during the academic year 2020 - 21 onwards)

Sem	Subject code	Course	Subject title	Hrs/week	Credit	Int. marks	Ext. marks	Tot. marks
I	20P1PH01	Core-I	Mathematical Physics	6	5	25	75	100
	20P1PH02	Core-II	Classical and Statistical Mechanics	6	5	25	75	100
	20P1PH03	Core-III	Advanced Electronics	6	5	25	75	100
	20P1PHE01	Elective-I	Elective-I Nano Science	4	3	25	75	100
	20P2PHP01	Core Practical	Practical I – Advanced Electronics Experiments	4	-	-	-	-
	20P2PHP02	Core Practical	Practical II – Advanced physics Experiments-I	4	-	-	-	-
			Total	30	18	100	300	400
II	20P2PH04	Core-IV	Electromagnetic Theory	6	5	25	75	100
	20P2PH05	Core-V	Quantum Mechanics-I	6	5	25	75	100
	20P2PH06	Core-VI	Spectroscopy	6	5	25	75	100
	20P2PHE07	Elective-II	Elective-II Medical Physics	4	3	25	75	100
	20P2PHP01	Core Practical-I	Practical I – Advanced Electronics Experiments	4	4	40	60	100
	20P2PHP02	Core Practical-II	Practical II – Advanced physics Experiments-I	4	4	40	60	100
			Total	30	26	180	420	600
III	20P3PH07	Core-VII	Condensed Matter Physics	5	5	25	75	100
	20P3PH08	Core-VIII	Quantum Mechanics-II	6	5	25	75	100
	20P3PH09	Core-IX	Microprocessor and Microcontroller	5	5	25	75	100
	20P3PHED1	EDC	Solar energy	4	4	25	75	100
	20P4PHP03	Core Practical-III	Practical III – Microprocessor Experiments	4	-	-	-	-
	20P4PHP04	Core Practical-IV	Practical IV – Advanced physics Experiments-II	4	-	-	-	-
	20P3HR01		Human Rights	2	1	25	75	100
			Total	30	20	125	375	500
IV	20P4PH10	Core-X	Nuclear and Particle Physics	6	5	25	75	100
	20P4PH11	Core-XI	Communication Systems	6	5	25	75	100
	20P4PHE03	Elective - III	Elective – III Thin Film Technology	4	3	25	75	100
	20P4PHP03	Core Practical	Practical III – Microprocessor Experiments	4	4	40	60	100
	20P4PHP04	Core Practical	Practical IV – Advanced physics Experiments-II	4	4	40	60	100
	20P4PHPR01	Core-XI	Project work	6	5	80	120	200
			Total	30	26	235	465	700
<b>Overall Total</b>				<b>120</b>	<b>90</b>	<b>640</b>	<b>1560</b>	<b>2200</b>

**Credit: 5**  
**Max. Hours: 60**

**MATHEMATICAL PHYSICS**

**Paper Code: 18P1PH01**

**Subject Description:** This course covers a broad spectrum of mathematical techniques essential to the solution of advanced problems in physics.

**Goal & Objectives**

- To apply advanced mathematical and computational techniques to complex physics problems.
- The main objective of this course is to provide the student with the repertoire of mathematical methods that are essential to the solution of advanced problems encountered in the fields of applied physics.

**Unit-I Complex Analysis**

**5%**

**Functions of complex variable**, Cauchy–Riemann condition, differential equation, Cayley integral theorem, **Cauchy integral theorem**, Cauchy integral formulas, Taylor’s series, Laurents’s series, Residue theorem, evaluation of definite integrals, Contour integration.

**Unit-II Tensors and matrix theory**

**25%**

**12**

Transformation of coordinates, linear vector space – subspaces – **linear independent –and orthogonality of vector – hilderts space transfor – motion of co ordinates – 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

**Unit-III Fourier series and Laplace Transforms**

**5%**

**14**

Fourier transform, properties of fourier transform, fourier transform of derivative, Fourier’s sine and cosine transform of derivative complex representation of fourier series, Fourier’s integral, different forms of fourier integrals.

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 Inverse Laplace Transform, **Convolution theorem** Applications of Laplace transform.

**Unit-IV Special Functions and differential Equations**

**5%**

**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.

**Liouville problem**, solution for Bessel –Legendre-lagure and Hermite differential equation-properties, Generating functions, Rodrigue’s formula, orthogonal properties, Recurrence relation.

### Unit-V Group Theory

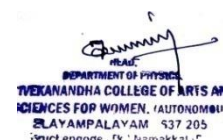
**5%**

**10**

Basic Definition, Multiplication Table, Sub groups, Cosets and Classes, Direct Product groups, Point group, Space groups, Symmetry elements and symmetry operations, Representation theory, Homomorphism and isomorphism, Reducible and irreducible representation , Schur’s lemma , The great orthogonality theorem, character table- $C_{2V}$  and  $C_{3V}$  as examples. **Elementary ideas of rotation group.**

### Books for Study:

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



**Max. Hours: 60**

**MATHEMATICAL PHYSICS**

**Paper Code: 20P1PH01**

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**Unit-I Complex vector Analysis**

**25%**

**10**

Element of complex analysis random variables, binomial, poisson normal distribution.

Central limit theorem- element of computational technique, root of function, interpolation, extrapolation, integration by trapezoid and Simpson rule, solution of first order differential equation differential rule -Cauchy-Riemann condition, differential equation, Cayley integral theorem, Cauchy integral theorem, Cauchy integral formulas, Taylor's series, Laurent's series, Residue theorem, evaluation of definite integrals, Contour integration.

**Unit-II Vector Tensors and matrix**

**5%**

**12**

Transformation of coordinates, Symmetric and antisymmetric tensors, Contraction of tensor, Characteristic equation of a matrix, Eigen values and eigen vectors, Cayley-Hamilton theorem, Reduction of a matrix to diagonal form, Jacobi method, Sylvester's Theorem.

**Unit-III Fourier series and Laplace Transforms**

**5%**

**14**

Fourier transform, properties of Fourier transform, Fourier transform of derivative, Fourier's sine and cosine transform of derivative complex representation of Fourier series, Fourier's integral, different forms of Fourier Transform 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 Inverse Laplace Transform, Applications of Laplace transform.

**Unit-IV Special Functions and differential Equations**

**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.

Liouville problem, solution for Bessel -Legendre-laguerre and Hermite differential equation-

properties, Generating functions, Rodrigue's formula, orthogonal properties, Recurrence relation.

### **Unit-V Group Theory**

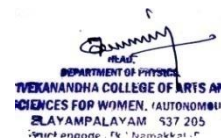
**5%**

**10**

Basic Definition, Multiplication Table, Sub groups, Cosets and Classes, Direct Product groups, Point group, Space groups, Symmetry elements and symmetry operations, Representation theory, Homomorphism and isomorphism, Reducible and irreducible representation, Schur's lemma, **treatment of molecular structure**, The great orthogonality theorem, character table- $C_{2V}$  and  $C_{3V}$  as examples.

### **Books for Study:**

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



**Credit: 5**  
**Max. Hours: 60**

**CLASSICAL AND STATISTICAL MECHANICS**

**Paper Code: 18P1PH02**

**Subject Description:** Classical & Statistical mechanics is studied rigorously using advanced mathematical and numerical techniques.

**Goal:** The main goal of the course is to introduce students to classical mechanics and its applications in physics

**Objectives**

- To develop fundamental concepts in mechanics more rigorously as needed for further study in physics and technology.
- To contribute to the development of the students thinking process through the understanding of the theory and application of this knowledge to the solution of the practical problems.

**Unit-I Fundamental Principles and Lagrangian Formulation** **15%** **12**

Mechanics of a particle and system of particles, Conservation laws , Constraints, Generalized coordinates, **Application of Lagranges formulation -Linear harmonic oscillator -simple pendulum**- conservation theorems and symmetry properties .

**Unit-II Hamilton's Formulation** **5%** **12**

Hamilton's canonical equations of motion, Physical Significance of H-Hamilton's canonical equations from variational principle , Principle of least action , Canonical transformations , Poisson brackets, Hamilton, **properties of hamilton** - Jacobi method , Harmonic oscillator problem using Hamiltonian Jacobi method, Lagrange's brackets, Properties.

**Unit-III Rigid Body Motion** **5%** **12**

Generalized coordinates for Rigid Body Motion, **motion of symmetrical top**- Euler Angles, Angular Velocity, Angular Momentum of a rigid body, Moments and Products of Inertia, Euler's equation.

**Relativistic Approach**

Lorentz transformation, Kinematic effects of Lorentz transformation, mass energy equivalence, Lagrangian formulation of Relativistic mechanics, Hamiltonian Formulation of Relativistic mechanics.

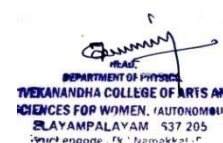
**Unit-IV Classical Statistics** **12**

Phase space, Ensembles, Definition of Micro Canonical, Canonical and Grand Canonical ensembles, Liouville's theorem, Microstates and Macro states, Partition function, Doppler broadening of spectral lines, Principle of equipartition of energy, connection between Partition function and Thermodynamically quantities.

Identical particles and symmetry requirements, **Application of fermi dirac gas** -and Fermi, Dirac statistics. Ideal Bose Einstein gas and its application: Black body radiation and Planck Radiation Law, Gas degeneracy, Bose Einstein Condensation, Ideal Fermi Dirac gas and its application: Electron gas, Thermionic emission, Pauli's theory of Paramagnetism.

**Books for Study:**

1. Classical Mechanics, Gupta and Kumar, Pragati Prakashnan, Meerut (2005).
2. Classical Mechanics, H. Goldstein, Narosa Publishing House, New Delhi.(2005)
3. Classical Mechanics, . C.R.Mondal, Prentice - Hall of India, New Delhi.
4. Statistical Mechanics, Gupta and Kumar, Pragati Prakashnan, Meerut (2005).
5. Statistical Mechanics, B.K. Agarwal and M. Eisner, New Age International, 2nd Edition, New Delhi. (1998).
6. Statistical Mechanics, Satya Prakash, Pragati Prakashan, Meerut (2005) .



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**Objectives**

- To develop fundamental concepts in mechanics more rigorously as needed for further study in physics and technology.
- To contribute to the development of the students thinking process through the understanding of the theory and application of this knowledge to the solution of the practical problems.

**Unit-I Fundamental Principles and Lagrangian Formulation** **20%** **12**

Mechanics of a particle and system of particles, Conservation laws , Constraints, Generalized coordinates- D' Alembert's principle and Lagrange's equation, Hamilton's principle , Lagrange's equation of motion, conservation theorems and symmetry properties- Atwood Machine particle moving surface of the earth.

**Unit-II Hamilton's Formulation** **15%** **12**

Hamilton's canonical equations of motion, Physical Significance of H-Hamilton's canonical equations from variational principle , Principle of least action , Canonical transformations , Poisson brackets, Hamilton, modified Jacobi principle , Harmonic oscillator problem using Hamiltonian Jacobi method, Lagrange's brackets, Properties of Hamilton.

**Unit-III Rigid Body Motion** **15%** **12**

Generalized coordinates for Rigid Body Motion, Euler Angles, Angular Velocity, Angular Momentum of a rigid body, Body and space reference system – components of angular velocity - Moments and Products of Inertia, Euler's equation.

**Relativistic Approach**

Lorentz transformation, Kinematic effects of Lorentz transformation, mass energy equivalence, Lagrangian formulation of Relativistic mechanics, Hamiltonian Formulation of Relativistic mechanics.

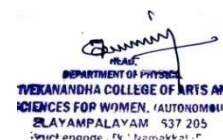
**Unit-IV Classical Statistics** **12**

Phase space, Ensembles, Definition of Micro Canonical, Canonical and Grand Canonical ensembles, Liouville's theorem, Microstates and Macro states, Partition function, Doppler broadening of spectral lines, Principle of equipartition of energy, connection between Partition function and Thermodynamically quantities.

Identical particles and symmetry requirements, Maxwell's, Bose-Einstein -Ideal Bose Einstein gas and its application: Black body radiation and Planck Radiation Law, Gas degeneracy, Bose Einstein Condensation, Ideal Fermi Dirac gas and its application: Electron gas, Thermionic emission, Pauli's theory of Paramagnetism.

**Books for Study:**

1. Classical Mechanics, Gupta and Kumar, Pragati Prakashnan, Meerut (2005).
2. Classical Mechanics, H. Goldstein, Narosa Publishing House, New Delhi.(2005)
3. Classical Mechanics, . C.R.Mondal, Prentice - Hall of India, New Delhi.
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6. Statistical Mechanics, Satya Prakash, Pragati Prakashan, Meerut (2005).



## ADVANCED ELECTRONICS

Paper Code: 18P1PH03

**Subject Description:** The aim of the course is to introduce the students to the advanced concepts of electronics.

### Goal & Objectives

- An understanding of basic analog circuit designs.
- The primary objective of this course is to understand and implement the advanced electronic circuits with the help of theoretical and practical problem solving.

### Unit-I **Operational Amplifier** **10%** **12**

**Amplifiers:** Basic information, Ideal op-amp, Open loop operation, Feedback in ideal op-amp, Inverting and Non-inverting op-amp, Voltage Follower, Differential op-amp, 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** **10%** **12**

Basic Op-amp Applications, Sample and hold circuits, logarithmic amplifiers, antilogarithmic amplifiers. Analog multiplier, analog divider, Differentiator, Integrator, Analog computation (solving simultaneous equation).

**Sine wave oscillation** with phase shift and wein's network, comparator, Schmitt trigger, **Astable and monostable operations** triangular wave generator.

### Unit-III **Filters and Data Converters** **10%** **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 notch filters.**

**DAC** **binary weighted resistor**, R-2R Ladder. ADC- Counter type, **successive approximation method**, Dual slope ADC, resolution, accuracy and linearity.

### Unit-IV **IC Fabrication** **10%** **12**

Basic monolithic IC's – thin film fabrication - epitaxial growth, masking, etching, impurity diffusion, fabricating monolithic resistors, diodes, transistors, inductors and capacitors.

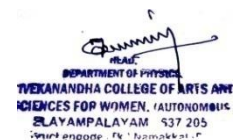
IC 555 timer, description of the functional diagram, mono stable **operation**, astable **operation**, Bi-Stable **Operation**, schmitt trigger.

**ROM**-PROM, EPROM, EEPROM, EAROM. RAM- Static RAM - Dynamic RAM and integrated RAM, Floppy Disk, Compact Disk.

Solar cells, LED, photo diode, Pin Diode, LCD, LDR.

**Books for Study:**

1. Handbook of Electronics, Gupta and Kumar, Pragati Prakashnan, Meerut.
2. Linear Integrated Circuits, D. Roy, New Age Publications.
3. Semiconductor Devices, S.M. Sze, Wiley Publications.
4. Principles of Electronics, V.K.Mehta, S.Chand Publication
5. Electronic Measurement and instrumentation, William Cooper, TMG Hill.
6. Operational Amplifier, Gayakwad, TMG Hill.
7. Integrated Electronics, J.Milman and C.C. Halkias, McGraw Hill (1972).
8. Digital Electronics ,V.K.Puri,Tata McGraw-Hill Publication.



**ADVANCED ELECTRONICS**

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**Goal & Objectives**

- An understanding of basic analog circuit designs.
- The primary objective of this course is to understand and implement the advanced electronic circuits with the help of theoretical and practical problem solving.

**Unit-I Operational Amplifier**

**5%**

**12**

Operational amplifiers: Basic information, Ideal op-amp, Open loop operation, Feedback in ideal op-amp, Inverting and Non-inverting op-amp, Voltage Follower, Differential op-amp, 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**

**5%**

**12**

Basic Op-amp Applications, Sample and hold circuits, logarithmic amplifiers, antilogarithmic amplifiers. Analog multiplier, analog divider, Differentiator, Integrator, Analog computation (solving simultaneous equation).

Sine wave oscillator with RC phase shift and wein's bridge oscillator square and comparator, Schmitt trigger, Astable and monostable multivibrator, triangular wave generator.

**Unit-III Filters and Data Converters**

**5%**

**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 DA Techniques - weighted resistor DAC, R-2R Ladder. ADC- Counter type, successive approximation method, Dual slope ADC, resolution, accuracy and linearity.

**Unit-IV IC Fabrication**

**25%**

**12**

Basic monolithic IC's – 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, internal architecture and working mono stable multivibrator, astable multivibrator, Bi-Stable multivibrator, linear opamp generator frequency

divider, schmitt trigger – application of astable mode – phase locked loops – Monolithic phase locked loops.

## Unit- V Memory and Optoelectronic Devices

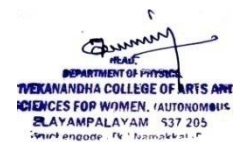
12

Architecture ROM-PROM, EPROM, EAROM. RAM- Static RAM - Dynamic RAM and integrated RAM, Floppy Disk, Compact Disk.

Solar cells, LED, photo diode, Pin Diode, LCD, LDR.

### **Books for Study:**

1. Handbook of Electronics, Gupta and Kumar, Pragati Prakashnan, Meerut.
2. Linear Integrated Circuits, D. Roy, New Age Publications.
3. Semiconductor Devices, S.M. Sze, Wiley Publications.
4. Principles of Electronics, V.K.Mehta, S.Chand Publication
5. Electronic Measurement and instrumentation, William Cooper, TMG Hill.
6. Operational Amplifier, Gayakwad, TMG Hill.
7. Integrated Electronics, J.Milman and C.C. Halkias, McGraw Hill (1972)
8. Digital Electronics , V.K.Puri, Tata McGraw-Hill Publication.



**Credit: 5**

**Max. Hours: 60**

## **ELECTROMAGNETIC THEORY**

**Paper Code: 18P2PH04**

**Subject Description:** Electromagnetic theory exposes the students to the fundamentals of electromagnetic fields and their applications in Physics.

### **Goal & Objectives**

- To provide the basic skills required to understand, develop, and design various physics applications involving electromagnetic fields.

### **Unit-I Electrostatics**

**10%**

**14**

Gauss Law and its application-Laplace and Poisson's equation, solution of Laplace equation in spherical coordinate, **Conducting sphere**, multipole expansion. **Electrostatic energy in dielectrics**-polarization and displacement vectors, boundary conditions, dielectric sphere in a uniform field, molecular polarizability and electrical susceptibility, electrostatic energy in dielectric medium, Clausis-Mossotti equation.

### **Unit-II Magnetostatics**

**10**

Biot-Savart's law, divergence and curl of magnetic induction, magnetic vector potential, Ampere's 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, boundary conditions, uniformly magnetized sphere. Magnetic Scalar & Vector potential-Characteristics

### **Unit-III Electromagnetics**

**10**

Faraday's law of induction, Maxwell's equation in free space and isotropic media, Maxwell's displacements current, vector and scalar potential, boundary conditions on the field at interfaces, Gauge transformation, Lorentz Gauge, Coulomb Gauge, conservation laws for a system of charges, Poynting theorem.

### **Unit-IV Wave Propagation**

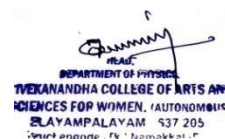
**14**

Propagation of an electromagnetic wave in free space, conducting and non conducting medium, skin depth, reflection and transmission at dielectric boundaries, polarization, Fresnel's 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.

Plasma, Debye length, plasma oscillations, plasma behaviour in a magnetic field, Boltzmann equation, magneto hydrodynamic equations, electron plasma oscillations, Debye shielding problem, plasma confinement in a magnetic field, pinch effect, magneto hydrodynamic waves, Alfvén waves, dynamics of charged particle in uniform electromagnetic fields.

**Books for Study:**

1. Introduction to Electromagnetics, Griffith, Prentice Hall of India.
2. Classical Electrodynamics, J.D. Jackson, John Wiley Publishers.
3. Electromagnetic Waves and Fields, Paul Corson and Dale, CBS Publishers.
4. Fundamentals of Electromagnetics, M.A. Wazed, TMC Publishing.
5. Basic Electromagnetics with Application, N. Narayana, Prentice Hall of India.
6. Electromagnetic Theory and Applications, Umesh Sinha, Tech India Publications.
7. Electromagnetic Waves and Radiating Systems, Edward and Keith, Prentice Hall of India.
8. Foundations of Electromagnetic Theory, John Reitz, Narosa Publishing House.
9. Electro magnetic Theory And Electro Dynamics, Sathya prakash.



Credit: 5

Max. Hours: 60

## ELECTROMAGNETIC THEORY

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**Subject Description:** Electromagnetic theory exposes the students to the fundamentals of electromagnetic fields and their applications in Physics.

### Goal & Objectives

- To provide the basic skills required to understand, develop, and design various physics applications involving electromagnetic fields.

### Unit-I Electrostatics

14

Gauss Law and its application-Laplace and Poisson's equation, solution of Laplace equation in spherical coordinate, point charge in front of a conducting sphere -, multipole expansion. Electrostatic energy, dielectrics-polarization and displacement vectors, boundary conditions, dielectric sphere in a uniform field, molecular polarizability and electrical susceptibility, electrostatic energy in dielectric medium, Clausis-Mossotti equation.

### Unit-II Magnetostatics

10

Biot-Savart's law, divergence and curl of magnetic induction, magnetic vector potential, Ampere's 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, boundary conditions, uniformly magnetized sphere. Magnetic Scalar & Vector potential-Characteristics

### Unit-III Electromagnetics

10

Faraday's law of induction, Maxwell's equation in free space and isotropic media, Maxwell's displacements current, vector and scalar potential, boundary conditions on the field at interfaces, Gauge transformation, Lorentz Gauge, Coulomb Gauge, conservation laws for a system of charges, Poynting theorem.

### Unit-IV Wave Propagation

14

Propagation of an electromagnetic wave in free space, conducting and non conducting medium, skin depth, reflection and transmission at dielectric boundaries, polarization, Fresnel's 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

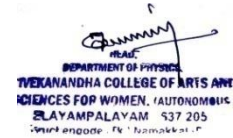
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Plasma, Debye length, plasma oscillations, plasma behaviour in a magnetic field, Boltzmann equation, magneto hydrodynamic equations, electron plasma oscillations, Debye

shielding problem, plasma confinement in a magnetic field, pinch effect, magneto hydrodynamic waves, Alfvén waves, dynamics of charged particle in uniform electromagnetic fields.

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8. Foundations of Electromagnetic Theory, John Reitz, Narosa Publishing House.
9. Electro magnetic Theory And Electro Dynamics, Sathya prakash.



**Max. Hours: 60**

## QUANTUM MECHANICS - I

**Paper Code: 18P2PH05**

**Subject Description:** Quantum mechanics, a backbone of physics explains the behavior of matter and its interactions with energy on the scale of atoms and subatomic particles.

### Goal & Objectives

- The primary objective of this course is to develop familiarity with the physical concepts and facility with the mathematical methods of quantum mechanics
- A secondary, but still very important objective is to cultivate your skills at formulating and solving physics problems.

### Unit- I General formalism of quantum mechanics **15%** **12**

Linear Vector Space, Linear Operator, Eigen Functions and Eigen Values, Hermitian Operator, Postulates of Quantum Mechanics, Simultaneous Measurability of Observables, General Uncertainty Relation, Dirac's Notation, Equations of Motion; Schrodinger, **Heisenberg and Dirac representation**, momentum representation.

### Unit- II Angular Momentum **12**

Orbital Angular Momentum, Spin Angular Momentum, Total Angular Momentum Operators, Commutation Relations of Total Angular Momentum with Components, Ladder operators, Commutation Relation of  $J_z$  with  $J_+$  and  $J_-$ , Eigen values of  $J^2$ ,  $J_z$ , Matrix Representation of  $J^2$ ,  $J_z$ ,  $J_+$  and  $J_-$ , Addition of angular momenta, Clebsch Gordon Coefficients – Properties.

### Unit-III Matrix Formulation of Quantum Mechanics **5%** **12**

Eigen values, Eigen vectors: Characteristic equation of a Dirac's Bra and Ket vectors: Dual space, **coordinate and momentum representation**, Projection Operator, Matrix theory of harmonic oscillator.

### Unit- IV Approximate Methods **12**

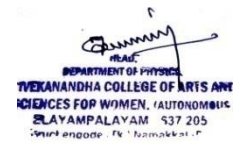
Time Independent Perturbation Theory in Non-Degenerate Case, Ground State of Helium Atom, Degenerate Case, Stark Effect in Hydrogen, Spin-orbit interaction, Variation Method & its Application to Hydrogen Molecule, WKB Approximation.

### Unit-V Time Dependent Perturbation Theory **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, Collision, Adiabatic Approximation.

## **Books for Study:**

1. Advanced Quantum Mechanics, Satya Prakash, Kedar Nath Ram Nath Publications.
2. A text book of Quantum Mechanics, Mathews and Venkatesan, TMG Hill.
3. Quantum Mechanics, Claude, Frank and Bernard, John Wiley Interscience.
4. Quantum Mechanics, Jasprit Singh, John Wiley Interscience.
5. Quantum Mechanics, Ghatak and Loganathan, Macmillan India.
6. Quantum Mechanics, Aruldhas, Prentice Hall of India.
7. Quantum Mechanics, Leonard, TMG Hill.
8. Quantum Mechanics, Eugen, John Wiley Interscience.



2020

ADDED

VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN  
(AUTONOMOUS)  
ELAYAMPALAYAM, TIRUCHENGODE

Credit: 5

Max. Hours: 60

## QUANTUM MECHANICS - I

Paper Code: 20P2PH05

**Subject Description:** Quantum mechanics, a backbone of physics explains the behavior of matter and its interactions with energy on the scale of atoms and subatomic particles.

### Goal & Objectives

- The primary objective of this course is to develop familiarity with the physical concepts and facility with the mathematical methods of quantum mechanics
- A secondary, but still very important objective is to cultivate your skills at formulating and solving physics problems.

### Unit- I General formalism of quantum mechanics

5%

12

Linear Vector Space, Linear Operator, Eigen Functions and Eigen Values, Hermitian Operator, Postulates of Quantum Mechanics, Simultaneous Measurability of Observables, General Uncertainty Relation, Dirac's Notation; Schrodinger, Heisenberg and Dirac pictures, momentum representation.

### Unit- II Angular Momentum

12

Orbital Angular Momentum, Spin Angular Momentum, Total Angular Momentum Operators, Commutation Relations of Total Angular Momentum with Components, Ladder operators, Commutation Relation of  $J_z$  with  $J_+$  and  $J_-$ , Eigen values of  $J^2$ ,  $J_z$ , Matrix Representation of  $J^2$ ,  $J_z$ ,  $J_+$  and  $J_-$ , Addition of angular momenta, Clebsch Gordon Coefficients – Properties.

### Unit-III Matrix Formulation of Matrix Mechanics

15%

12

Eigen values, Eigen vectors: Characteristic equation of a matrix, Schrödinger, Heisenberg and interaction matrix representation, Dirac's Bra and Ket vectors: Dual space, Hilbert space Projection Operator, Matrix theory of harmonic oscillator.

### Unit- IV Approximate Methods

12

Time Independent Perturbation Theory in Non-Degenerate Case, Ground State of Helium Atom, Degenerate Case, Stark Effect in Hydrogen, Spin-orbit interaction, Variation Method & its Application to Hydrogen Molecule, WKB Approximation.

### Unit-V Time Dependent Perturbation Theory

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, Collision, Adiabatic Approximation.

## **Books for Study:**

1. Advanced Quantum Mechanics, Satya Prakash, Kedar Nath Ram Nath Publications.
2. A text book of Quantum Mechanics, Mathews and Venkatesan, TMG Hill.
3. Quantum Mechanics, Claude, Frank and Bernard, John Wiley Interscience.
4. Quantum Mechanics, Jasprit Singh, John Wiley Interscience.
5. Quantum Mechanics, Ghatak and Loganathan, Macmillan India.
6. Quantum Mechanics, Aruldas, Prentice Hall of India.
7. Quantum Mechanics, Leonard, TMG Hill.
8. Quantum Mechanics, Eugen, John Wiley Inter science.



## SPECTROSCOPY

Paper Code: 18P2PH06

**Subject Description:** This course provides a basic knowledge of different types of spectroscopic methods in theoretical aspects.

### Goal & Objectives

- To provide the basic knowledge of interpreting different spectra.
- To study the spectroscopic methods for quantitative and qualitative analysis.

### Unit- I **Microwave Spectroscopy** **15%** **12**

Rotation of molecules and their spectra, diatomic molecules, intensity of line spectra, the effect of isotopic substitution, **quadrupole hyperfine interaction**- non-rigid rotator and their spectra, polyatomic molecules (Linear and symmetric top molecules), **Classical theory of Raman spectroscopy**, pure rotational- **Vibrational of polyatomic molecules** Raman spectra (linear and symmetric top molecules).

### Unit -II **IR and Raman Spectroscopy** **5%** **12**

**The energy of diatomic molecules**, Simple Harmonic Oscillator, the Anharmonic oscillator, the diatomic vibrating rotator, vibration-rotation spectrum of carbon monoxide, Breakdown of Born-Oppenheimer approximation, the vibrations of polyatomic molecules, Influence of rotation on the spectra of polyatomic molecules (linear and symmetric top Molecules)

Raman Effect, Classical Theory & Quantum Theory of Raman Effect, Selection Rules, Degree of depolarization, Rotational Raman Spectrum, Vibrational Raman Spectrum, Structure determination using IR and Raman spectroscopy, Laser Raman Spectroscopy.

### Unit- III **Electronic Spectroscopy** **12**

Born-Oppenheimer approximation, vibrational spectra and their progressions, Franck-Condon principle, dissociation energy and their products, rotational fine structure of electronic, vibration transition, molecular orbital theory, the spectrum of molecular hydrogen, change of shape on excitation, chemical analysis by electronic spectroscopy, reemission of energy, fundamentals of UV photoelectron spectroscopy.

### Unit- IV **NMR & NQR Spectroscopy** **5%** **12**

**NMR Spectroscopy:** Quantum Mechanical and Classical Description, Bloch Equations, Relaxation Processes, **Experimental Technique**, Principle and Working of High Resolution NMR Spectrometer, Chemical Shift

**NQR Spectroscopy:** Fundamental Requirements, General Principle, Experimental Detection

**Unit- V ESR & Mossbauer Spectroscopy**

**5%**

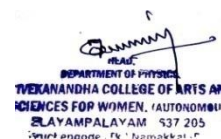
**12**

**ESR Spectroscopy:** Basic Principles, Experiments, **ESR Spectrometer**, Reflection Cavity and Microwave Bridge, ESR Spectrum, Hyperfine Structure.

**Mossbauer Spectroscopy:** Mossbauer Effect, Recoilless Emission and Absorption, Mossbauer Spectrum, Experimental Methods, Hyperfine Interaction, Chemical Isomer Shift, Magnetic Hyperfine.

**Books for Study:**

1. Vibrational Spectroscopy, Sathyanarayana, New Age International Publications.
2. Molecular Structure and Spectroscopy, Aruldas, Prentice Hall of India.
3. Fundamentals of Molecular Spectroscopy, Banwell, TMG Hill.
4. Spectroscopy I, Straughan and Walkar, Chapman and Hall.
5. Spectroscopy II, Straughan and Walkar, Chapman and Hall.
6. Modern Molecular Spectroscopy, Randhava, Macmillan India.
7. Nuclear Magnetic Resonance, Rahman, Springer Verlag.
8. C. N. Banwell, Fundamentals of Molecular Spectroscopy (McGraw Hill).



Credit: 5

Max. Hours: 60

## SPECTROSCOPY

Paper Code: 20P2PH06

**Subject Description:** This course provides a basic knowledge of different types of spectroscopic methods in theoretical aspects.

### Goal & Objectives

- To provide the basic knowledge of interpreting different spectra.
- To study the spectroscopic methods for quantitative and qualitative analysis.

### Unit- I Atomic and Microwave Spectroscopy 40% 12

Rotation of molecules and their spectra, diatomic molecules, intensity of line spectra, the effect of isotropic substitution, -quantum states of electron in atom - -H atom spectrum -electron spin - stern garlach experiment -non-rigid rotator and their spectra, polyatomic molecules (Linear and symmetric top molecules), microwave spectrometer -Classical theory of Raman Effect, Zeeman effect, pure rotational Raman spectra (linear and symmetric top molecules).

### Unit -II IR and Raman Spectroscopy 12

The energy of diatomic molecules, Simple Harmonic Oscillator, the Anharmonic oscillator, the diatomic vibrating rotator, vibration-rotation spectrum of carbon monoxide, Breakdown of Born-Oppenheimer approximation, the vibrations of polyatomic molecules, Influence of rotation on the spectra of polyatomic molecules (linear and symmetric top Molecules)

Raman Effect, Classical Theory & Quantum Theory of Raman Effect, Selection Rules, Degree of depolarization, Rotational Raman Spectrum, Vibrational Raman Spectrum, Structure determination using IR and Raman spectroscopy, Laser Raman Spectroscopy.

### Unit- III Electronic Spectroscopy 12

Born-Oppenheimer approximation, vibrational spectra and their progressions, Franck-Condon principle, dissociation energy and their products, rotational fine structure of electronic, vibration transition, molecular orbital theory, the spectrum of molecular hydrogen, change of shape on excitation, chemical analysis by electronic spectroscopy, reemission of energy, fundamentals of UV photoelectron spectroscopy.

### Unit- IV NMR & NQR Spectroscopy 5% 12

**NMR Spectroscopy:** Quantum Mechanical and Classical Description, Bloch Equations, Relaxation Processes, Experimental Technique, Principle and Working of High Resolution NMR Spectrometer, Chemical Shift.

**NQR Spectroscopy:** Fundamental Requirements, General Principle, Experimental Detection of NQR Frequencies, Interpretation and Chemical Explanation of NQR Spectroscopy, Basics principle MRI spectroscopy.

**Unit- V ESR & Mossbauer Spectroscopy**

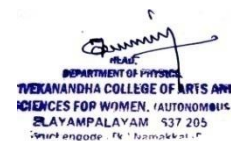
**12**

**ESR Spectroscopy:** Basic Principles, Experiments, ESR Spectrometer, Reflection Cavity and Microwave Bridge, ESR Spectrum, Hyperfine Structure.

**Mossbauer Spectroscopy:** Mossbauer Effect, Recoilless Emission and Absorption, Mossbauer Spectrum, Experimental Methods, Hyperfine Interaction, Chemical Isomer Shift, Magnetic Hyperfine.

**Books for Study:**

1. Vibrational Spectroscopy, Sathyanarayana, New Age International Publications.
2. Molecular Structure and Spectroscopy, Aruldas, Prentice Hall of India.
3. Fundamentals of Molecular Spectroscopy, Banwell, TMG Hill.
4. Spectroscopy I, Straughan and Walkar, Chapman and Hall.
5. Spectroscopy II, Straughan and Walkar, Chapman and Hall.
6. Modern Molecular Spectroscopy, Randhava, Macmillan India.
7. Nuclear Magnetic Resonance, Rahman, Springer Verlag.
8. C. N. Banwell, Fundamentals of Molecular Spectroscopy (McGraw Hill).



Credit: 4

Max. Hours: 48

NANO SCIENCE

Paper Code: 18P1PHE01

**Subject Description:** This gives an basic knowledge about Nanotechnology, its characterization and applications.

### Goal & Objectives

- To provide the basic skills required to understand, develop, and design Nanomaterials.
- To enhance the research interest in Nanotechnology.

### Unit-I Introduction 10

Introduction, classification of nano materials, nano particles and nano powders, nano structured materials, Quantum dots-Wells and Wires, Molecule to Bulk Transition, mechanism of formation of nanostructures, special nano structured materials, micro and mesoporous materials.

### Unit-II Synthesis Techniques 10

**5%**  
Top down and bottom up approach, sol gel synthesis, spin coating, spray pyrolysis, hydrothermal growth, electrochemical deposition, electro spinning, Molecular beam epitaxy (PVD), Langmuir Blodgett films, self - assembled organic layer, core shell nanostructures, metal oxide, metal polymer and oxide polymer nanostructures.

### Unit-III Fullerenes 10

Synthesis and purification of fullerenes, pressure effects, optical and some unusual properties, ferromagnetism in fullerenes.

Synthesis and purification of Carbon nanotubes, mechanism of growth, electronic structure- transport properties, mechanical properties, physical properties, applications.

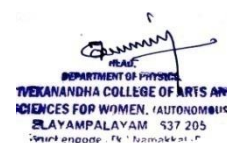
### Unit-IV Characterization 10

**20%**  
Scanning electron microscope (SEM), transmission electron microscope (TEM), atomic force microscope (AFM), scanning tunneling microscope (STM) - XPS – Working Principle, Instrumentation and Applications, tunnel diode, molecular transistor SET, SPT, Thin film self assembly- Photoluminescence (PL) Spectroscopy, Scanning Probe Microscopy (SPM), Artificial and tunable atom -Elemental dispersive X-ray analysis EDAX analysis, Scanning Conducting microscopy (SCM), High-resolution Transmission Electron Microscopy (HRTEM).

Medicine Applications: Therapies and diagnostics for cancer and central nervous system disorders, Drug delivery. Industrial Application: Nano crystalline Solar Cells, Fuel Cells. Military Applications: Nuclear Weapons, Nano robotics. Nanomaterials for (Health) food Applications

**Books for Study:**

1. Nano: The Essentials, T. Pradeep, TMG Hill.
2. Nanoscale materials in chemistry, Kenneth, John Wiley and Sons.
3. Science and technology of nanostructured magnetic materials, George, Plenum Press, New York.
4. Nanobiotechnology: Concepts, Applications, Perspectives, Christof, and Chad.



**VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN  
(AUTONOMOUS)  
ELAYAMPALAYAM, TIRUCHENGODE**

**Credit: 4  
Max. Hours: 48**

**NANO SCIENCE**

**Paper Code: 20P1PHE01**

**Subject Description:** This gives a basic knowledge about Nanotechnology, its characterization and applications.

**Goal & Objectives**

- To provide the basic skills required to understand, develop, and design Nanomaterials.
- To enhance the research interest in Nanotechnology.

**Unit-I Concepts of nanoscience 15% 10**

Introduction of nanoscale and quantum size effect- classification of nano materials, nano particles and nano powders, nano structured materials, Physical properties of nanoparticle Quantum dots-Wells and Wires, Molecule to Bulk Transition, mechanism of formation of nanostructures, special nano structured materials, micro and mesoporous materials.

**Unit-II Nano fabrication 15% 10**

Sol gel synthesis, spin coating, spray pyrolysis, hydrothermal synthesis, electrochemical deposition, electrospinning, Molecular beam epitaxy (PVD), chemical vapour deposition (CVD), Langmuir Blodgett films, core shell nanostructures, metal oxide, metal polymer and oxide polymer nanostructures.

**Unit-III Fullerenes 5% 10**

Synthesis and purification of fullerenes, pressure effects, optical and some unusual properties, ferromagnetism in fullerenes.

Synthesis and purification of Carbon nanotubes, mechanism of growth, electronic structure, UV analysis, DSC,DTA, TGA - transport properties, mechanical properties, physical properties, applications.

**Unit-IV Characterization 10% 10**

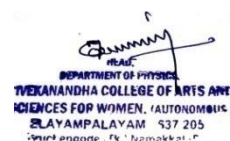
Scanning electron microscope (SEM), transmission electron microscope (TEM), Microwave Technique - XPS - Working Principle, Instrumentation and Applications, Photoluminescence (PL) Spectroscopy, Scanning Probe Microscopy (SPM), Carbon nano tube application -C<sub>60</sub> and basics of fullerenes -Elemental dispersive X-ray analysis EDAX analysis, Scanning Conducting microscopy (SCM), Nano ceramics - High-resolution Transmission Electron Microscopy (HRTEM).

**Unit-V Applications**

Medicine Applications: Therapies and diagnostics for cancer and central nervous system disorders, Drug delivery. Industrial Application: Nano crystalline Solar Cells, Fuel Cells. Military Applications: Nuclear Weapons, Nano robotics. Nanomaterials for (Health) food Applications

**Books for Study:**

1. Nano: The Essentials, T. Pradeep, TMG Hill.
2. Nanoscale materials in chemistry, Kenneth, John Wiley and Sons.
3. Science and technology of nanostructured magnetic materials, George, Plenum Press, New York.
4. Nanobiotechnology: Concepts, Applications, Perspectives, Christof, and Chad.



## Bio- Physics

Paper Code: 18P2PHE02

**Subject Description:** As a traditional field of research, Crystal physics introduces the structure and characterization techniques and applications of crystalline materials.

### Goal & Objectives

- To provide the basic skills required to understand, develop crystals having different applications.
- To provide basic knowledge in the research area of crystal physics.

### Unit-I BONDS

Ionization energy electron affinity - **10%** **chemical bonding** **pauli's exculsion principle** - electro negativity - strong bonds secondary bonds. Energies-forces-bonds: Interatomic potentials for strong and weak bonds - bond energies. Rates of reaction: reaction kinetics- water, acids, bases and aqueous reactions. Transport process: Diffusion - viscosity-thermal conduction

### Unit-II **RADIATION BIOLOGY**

**5%**

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

Bio - molecules and biological energy Biological polymers: Nucleic acids – DNA – RNA – conformation - proteins protein folding. Biological Membranes: Historical background – membrane chemistry and structure - membrane physics. Biological energy: Energy consumption respiration – photosynthesis – ATP synthesis

### Unit -IV NATURE OF ORGANISMS

**5%**

Movement of organisms Bacterial motion - chemical memory in primitive organisms - muscular movement - human performance, nerve signals and memory **Excitable membranes:** Diffusion and mobility of Ions - resting potential Nerve signals: Passive response -Nerve impulses (action potentials) - nervous system.

### UNIT V INSTRUMENTATION

**5%**

Control of movement Primary of movement - Ballistic control in a simplified visual system - more sophisticated - mode of control -structure of muscle fibers - central pattern generators - conditioned reflexes, **Relevant anatomy and Physioplogy** – volition - and Free will - consciousness Passive verses active in mental processing.

### Books for Study:

- 1.RodyneyM.J.Cotterill, Biophysics: An introduction, John Wiley and sons Publications, (2014).
- 2.Roland Glacier, Biophysics, Springer Publications, (2006).

**Medical Physics**

**Paper Code: 20P4PHE07**

**Subject Description:** As a traditional field of research, Crystal physics introduces the structure and characterization techniques and applications of crystalline materials.

**Goal & Objectives**

- To provide the basic skills required to understand, develop crystals having different applications.
- To provide basic knowledge in the research area of crystal physics.

<b>Content of the Syllabus</b>			
Unit - I	<b>X-RAY GENERATORS</b>	Periods	10
	Discovery - Production - Properties of X-rays - Characteristics and continuous spectra - Design of hot cathode X-ray tube - Basic requirements of medical diagnostic, therapeutic and industrial radiographic tubes - Rotating anode tubes - Hooded anode tubes - Rating of tubes – standard exposure charts, Limitations on loading Safety devices in X-ray tubes - Digital X-rays - X- rays Tomography		
Unit - II	<b>PARTICLE ACCELERATORS</b>	Periods	10
	Particle accelerators for industrial, medical and research applications - The Resonant transformer Cascade generator - Van De Graff Generator - Pelletron - Betatron - Synchro- Cyclotron- Linear Accelerator - Klystron and magnetron - Microtron -Special techniques in radiation therapy: Total body irradiation (TBI) – large field dosimetry – total skin electron therapy (TSET) –Positron emission Tomography (PET).		
Unit - III	<b>RADIATION SOURCES AND THEIR MEDICAL APPLICATIONS</b>	Periods	10
	Radiation sources - Natural and artificial radioactive sources – Cyclotron produced isotopes (20 F, 13 N, 15 O, 11 C) - Fission products (137 Cs, 99 Mo, 131 I, 90 Sr) – Requirement for brachytherapy sources - Beta ray applicators – ophthalmic applicators (90 Sr, 125 I, 106 Ru etc.,)		
Unit - IV	<b>LASERS IN MEDICINE</b>	Periods	9
	Lasers in medicine-applications of Ultrafast pulsed Lasers -Lasers in dermatology, and cell biology - Lasers in blood flow measurement - Fiber optics in medicine - microscopy in medicine - birefringence - Fluorescence microscope - confocal microscope - Hazards of lasers and their safety measures.		
Unit - V	<b>ULTRASOUND IN MEDICINE</b>	Periods	9
	Production, properties and propagation of ultrasonic waves - Bioacoustics – Acoustical characteristics of human body- Ultrasonic Dosimetry - High power ultrasound in therapy – Ultrasound cardiography (UCG) – Doppler effect -Double doppler shift – doppler systems - ultrasonic tomography -applications of ultrasound in medicine		
<b>Total Periods</b>			<b>48</b>

**Books for Study:**

- 1.Crystallography Applied to Solid State Physics, O.N.Srivastava, New Age International

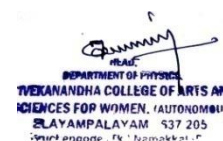
Publications.(second edition)

2.X-ray Structure Determination, Stout and Jensen, John Wiley Publications. .(second edition)

3.K.Sangawal, Elementary Crystal Growth – Sahan Publisher, UK, 1994.

**Books for Reference:**

- 1.The Growth of Crystals from Liquids, J.C. Brice, NHC Publishers (1973).
- 2.Fundamentals of Crystallography, Giacovazzo, Oxford University Press Publications (2011).
- 3.B.R.Pamplin, Progress in Crystal Growth Characterization, Pergamon Press Ltd. (UK)
- 4.X.F.Zong, Y.Y.Wang, J.Chen, Material and Process characterization for VLSI, World Scientific, New Jersey (1998).
- 5.M. William and D. Steve, Instrumental Methods of Analysis (CBS Publishers, New Delhi, (1986).
- 6.H. H. Williard, L. L. Merritt, J. Dean, and F. A. Settle, Instrumental Methods of Analysis – Sixth Edition, CBS Publishers & Distributors, Delhi (1986).



Credit: 5

Max. Hours: 60

### CONDENSED MATTER PHYSICS

Paper Code: 18P3PH07

**Subject Description:** This paper gives an idea about fundamentals of solids and its bond theory which will be used for studying solids and how they are formed.

**Goal:** To provide understanding of the enormously rich behavior of condensed matter systems under a wide variety of conditions.

#### Objectives

To probe the system by studying the

- Crystal properties
- Electrical and thermal transport
- optical interactions.

#### UNIT- I Electron Energy Bands

14

The Bloch's Theorem- the Kronig Penney model – zone schemes for energy bands-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 over lapping – Fermi surface-Anomalous skin effect-De Hass van Alphen effect and Brillouin zones.

#### UNIT- II Free Electron Theory of Metals

12

Free electron in metals- Drude Lorentz free electron theory –Electrical conductivity-Thermal conductivity-Weidemann Franz law- Sommerfield free electron theory –Mattiessen's 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 10%

12

Diamagnetism and ferromagnetism – Langevin classical theory of Diamagnetism – Weiss theory – Quantum theory of Paramagnetism – Demagnetization of a paramagnetic salt – Determination of susceptibility of para and diamagnetism using Guoy's method – Ferromagnetism – Spontaneous magnetization in ferromagnetic materials – Quantum theory of ferromagnetism – Curie - Weiss law – Weiss molecular field – Adiabatic demagnetization Ferromagnetic domains – Antiferromagnetism – Ferrimagnetism.

Superconductivity and its historical perspective-Critical Temperature-persistent current-Energy gap and its Temperature dependence - DC and AC Josephson effect – London equation - BCS theory –Flux quantization – Type I and Type II superconductors - Josephson tunneling effect – **SQUID** - Applications-High temperature Super conductors-High temperature Ceramic Super conductors.

**UNIT - V Semiconductor Devices****10**

Hall effect in semi conductors – vacuum level and work function of metals – Solar cells, Qualitative ideas of MEM's, Spintronics, quantum Dots (QD's) & Molecular Electronics.

**Book for Study and References:**

1. Introduction to solid state physics-C.Kittel (John Wiley and Sons),2005, 7<sup>TH</sup> Edition
2. Solid state physics – Gupta & Saxeena, Pragatti Praashan, 9th edition (2004).
3. Solid state physics- S.O.Pillai, New age Publication, 2nd edition (2002).
4. Material Science, S.L.Kakani, Amit Kakani, New Age International Publishers, 2010, 2<sup>nd</sup> Edition.
5. Super conductivity fundamentals and applications – W.Buckl, Wiley-VCH Publications, 2nd revised and enlarged edition (2004).

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Credit: 5  
Max. Hours: 60

CONDENSED MATTER PHYSICS

Paper Code: 20P3PH07

**Subject Description:** This paper gives an idea about fundamentals of solids and its bond theory which will be used for studying solids and how they are formed.

**Goal:** To provide understanding of the enormously rich behavior of condensed matter systems under a wide variety of conditions.

**Objectives:**

To probe the system by studying the

- Crystal properties
- Electrical and thermal transport
- optical interactions.

**UNIT- I Electron Energy Bands**

20%

14

Fundamental of crystalline states - Bravais lattice - Miller indices - simple crystal structure - SC-FCC -BCC ) The Bloch's Theorem- the Kronig Penney model - Fermi surface - density of states - basic concepts of energy bands- Brillouin zone - zone schemes for energy bands - 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 - Fermi surface - Anomalous skin effect - De Haas van Alphen effect and Brillouin zones.

**UNIT- II Free Electron Theory of Metals**

12

Free electron in metals - Drude Lorentz free electron theory - Electrical conductivity - Thermal conductivity - Weidemann Franz law - Sommerfeld free electron theory - Mattiessen's 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**

5%

12

Diamagnetism and ferromagnetism - Langevin classical theory of Diamagnetism - Weiss theory paramagnetism - Quantum theory of Paramagnetism - Demagnetization of a paramagnetic salt - Determination of susceptibility of para and diamagnetism using Gouy's method - Ferromagnetism - Spontaneous magnetization in ferromagnetic materials - Quantum theory of ferromagnetism - Curie - Weiss law - Weiss molecular field - Ferromagnetic domains - Antiferromagnetism - Ferrimagnetism.

**UNIT - IV Superconductivity****5%****12**

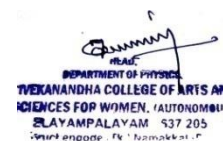
Superconductivity and its historical perspective-Critical Temperature-persistent current-Energy gap and its Temperature dependence - DC and AC Josephson effect – London equation - BCS theory – Flux quantization – Type I and Type II superconductors - Josephson tunneling effect – application power- Potential application of superconductivity -Applications-High temperature Super conductors-High temperature Ceramic Super conductors.

**UNIT - V Semiconductor Devices****5%****10**

Hall effect in semi conductors and Instrumentation – vacuum level and work function of metals – LED Photo diode - Solar cells, Qualitative ideas of MEM's, Spintronics, quantum Dots (QD's) & Molecular Electronics.

**Book for Study and References:**

- 1.Introduction to solid state physics-C.Kittel (John Wiley and Sons),2005, 7<sup>TH</sup> Edition
- 2.Solid state physics – Gupta & Saxeena, Pragatti Praashan, 9th edition (2004).
- 3.Solid state physics- S.O.Pillai, New age Publication, 2nd edition (2002).
- 4.Material Science, S.L.Kakani, Amit Kakani, New Age International Publishers, 2010, 2<sup>nd</sup> Edition.
- 5.Super conductivity fundamentals and applications – W.Buckl, Wiley-VCH Publications, 2nd revised and enlarged edition (2004).



Credit : 5  
Maximum Hours : 60

## QUANTUM MECHANICS –II

**PAPER CODE: 18P3PH08**

**Subject Description:** This paper describes the behaviour of matter and energy at the sub atomic scale.

**Goal:** To provide understanding of the semiclassical, quantum and quantum field approach to the physical system.

### Objectives

- To acquire knowledge of non-relativistic and relativistic quantum mechanics .
- The ability to understand concepts and to perform calculations of scattering of particles.
- The ability to critically understand and evaluate modern research utilizing quantum theory in condensed matter, nuclear and particle physics.

### UNIT I Semiclassical Theory of Radiation 10% 12

Emission & Absorption of radiation – Electric dipole approximation – Einstein’s Transition probabilities and A & B Coefficients – Selection rules – Quantisation of radiation field – interaction with matter – spontaneous & stimulated emissions.

#### Quantum theory of valence band

VB method – Hitler – London theory of Hydrogen molecule in VB method – directed bonds – **sp, sp<sup>2</sup>, sp<sup>3</sup> hybridisations – refinement of simple Mo & Vb approximation.**

### UNIT II Scattering Theory 15% 12

Scattering amplitude – Expression in terms of Green’s function – **Born approximation and its validity** – Partial wave analysis – Phase shifts – **Asymptotic behavior of partial waves** – The scattering amplitude in terms of phase shift – Scattering by Coulomb potential and **Yukawa potential** - Low energy scattering: Scattering length and effective range – **scattering by a perfectly rigid sphere.**

### UNIT III Many Electron Atoms 5% 12

Indistinguishable particles – Pauli’s principle – Inclusion of spin – **spin functions for two electrons**- The Helium atom – Central field approximation – Thomas Fermi model of the atom – Hatree Equation – Hatree- Fock Equation.

Symmetrical and Anti symmetrical wave functions – Hund’s rules – Atomic Structure – Effect of Magnetic Field – Hydrogen Atom – **Weak & Strong magnetic field**

### UNIT IV Relativistic Wave Equation 15% 12

Klein Gordan Equation –Phase Wave Equation – Charge and Current Density –Application to the study of Hydrogen like atom – Dirac Relativistic Equation for a free particle – Dirac matrices – free particle solutions – **plane wave solution** - Dirac Equation in Electromagnetic field – **Negative Energy states – Dirac’s equation in Covariant form.**

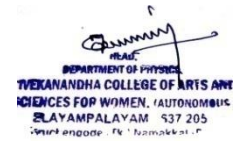
### UNIT V Quantum Field Theory 5% 12

Quantization of 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, **Energy and Momentum.**

#### Books for Study and References:

1. A text Book of Quantum Mechanics – P.M.Mathews & K.Venkatesan – Tata Mc Graw Hill, 2004.
2. Quantum Mechanica – G Aruldas- Prentice Hall of India 2006
3. Introduction to Quantum Mechanics – David J.Griffths – Pearson Prentice Hall 2009, 2<sup>ND</sup> edition.

4. Quantum Mechanics – V.Devanathan – Narosa Publishing – New Delhi, 2006.
5. Quantum Mechanics – A.K.Ghatak and S.Loganathan – McMillan India, 2003
6. Quantum Mechanics – Satyaprakash- Sultan Chand Publishers,2013.
7. Quantum Mechanics – Gupta Kumar Sharma- Jaiprakash Nath Publications, Meerut, 32<sup>nd</sup> Edition, 2013.
8. Quantum Mechanics – L. I. Schiff - Tata Mc Graw Hill- 2010 edition.



Credit : 5  
Maximum Hours : 60

## QUANTUM MECHANICS –II

PAPER CODE: 20P3PH08

**Subject Description:** This paper describes the behaviour of matter and energy at the sub atomic scale.

**Goal:** To provide understanding of the semiclassical, quantum and quantum field approach to the physical system.

### Objectives

- To acquire knowledge of non-relativistic and relativistic quantum mechanics .
- The ability to understand concepts and to perform calculations of scattering of particles.
- The ability to critically understand and evaluate modern research utilizing quantum theory in condensed matter, nuclear and particle physics.

### UNIT I **Theory of Radiation** 15% 12

Emission & Absorption of radiation – Electric dipole approximation – Einstein’s Transition probabilities and A & B Coefficients – Selection rules – Quantisation of radiation field – interaction with matter – spontaneous & stimulated emissions.

#### Quantum theory of valence band

VB method – Hitler – London theory of Hydrogen molecule in VB method – directed bonds – sp, sp<sup>2</sup>, sp<sup>3</sup> hybridisations.

### UNIT II **Scattering Theory** 10% 12

Scattering amplitude – Expression in terms of Green’s function – Scattering problem and formula Born approximation and its validity – Partial wave analysis - The Exponential and Gaussian potential – Phase shifts – Asymptotic behavior of partial waves – The scattering amplitude in terms of phase shift – Scattering by Coulomb potential and Yukawa potential - Low energy scattering: Scattering length and effective range – scattering by a perfectly rigid sphere.

### UNIT III **Many Electron Atoms** 10% 12

Indistinguishable particles – Pauli’s principle – Inclusion of spin - The Helium atom – Central field approximation – Thomas Fermi model of the atom – Hartree Equation – Hartree- Fock Equation.

Symmetrical and Anti symmetrical wave functions – Hund’s rules – Atomic Structure – Effect of Magnetic Field – Hydrogen Atom – Weak & Strong magnetic field.

### UNIT IV **Relativistic Wave Equation** 5% 12

Klein Gordan Equation –Phase Wave Equation – Charge and Current Density –Application to the study of Hydrogen like atom – Dirac Relativistic Equation for a free particle – Dirac matrices – free particle solutions - Dirac Equation in Electromagnetic field

### UNIT V **Quantum Field Theory** 12

Quantization of 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, Energy and Momentum.

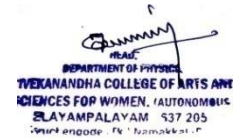
#### Books for Study and References:

1. A text Book of Quantum Mechanics – P.M.Mathews & K.Venkatesan – Tata Mc Graw Hill, 2004.
2. Quantum Mechanica – G Aruldas- Prentice Hall of India 2006
3. Introduction to Quantum Mechanics – David J.Griffths – Pearson Prentice Hall 2009, 2<sup>ND</sup> edition.
4. Quantum Mechanics – V.Devanathan – Narosa Publishing – New Delhi, 2006.
5. Quantum Mechanics – A.K.Ghatak and S.Loganathan – McMillan India, 2003

6. Quantum Mechanics – Satyaprakash- Sultan Chand Publishers, 2013.

7. Quantum Mechanics – Gupta Kumar Sharma- Jaiprakash Nath Publications, Meerut, 32<sup>nd</sup> Edition, 2013.

8. Quantum Mechanics – L. I. Schiff - Tata Mc Graw Hill- 2010 edition.

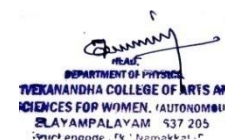




Instruction set of 8051 – Arithmetic, Logical, Data move jump and call instructions, Addressing modes – Immediate, register, direct and indirect addressing modes – Assembly language programming – simple programs to illustrate arithmetic and logical operations (Sum of numbers, biggest and smallest in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

**Books for Study and References:**

1. Microprocessor Architecture, Programming and Applications with 8085, Ramesh S. Gaonkar, III Edition, Penram International Publishing, 1997.
2. Fundamentals of Microprocessor and Microcomputers, B. Ram, V Edition, Dhanpat Rai publications (P) Ltd. New Delhi, 2003.
3. The 8051 Microcontroller – Architecture, Programming & Applications, Kenneth J. Ayala, II Edition., Penram International, India, 1996.



Credit : 5  
Maximum Hours: 60

## MICROPROCESSORS AND MICROCONTROLLER

PAPER CODE: 20P3PH09

**Subject Description:** This subject deals with the functions and principles of Micro Processors and Microcontrollers.

**Goal:** To learn about function of micro processors and Microcontrollers and operate them by learning with different features.

### Objectives

On successful completion of this subject the student should have

- The basic knowledge of computers and its processors.
- To operate the processors and controllers with basic idea.

### UNIT I EVOLUTION AND ARCHITECTURE OF MICROPROCESSORS 8085 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.

### UNIT II INSTRUCTION SETS & PROGRAMMING OF MICROPROCESSOR 8085 12

Assembly language, Instruction sets of 8085, Stacks, Counters, Subroutines, MACRO, Delay Subroutine. Examples of Assembly language Programming- addition- subtraction- To find the largest and smallest number in a data array- sorting-sum of a series- Multiplication- Division- multi-byte addition and subtraction.

### UNIT III APPLICATIONS OF MICROPROCESSORS 5% 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.

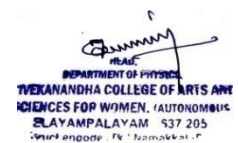
### UNIT IV ARCHITECTURE OF MICROCONTROLLER 8051 10% 12

Introduction – Water level indicator – Stepper motor – Traffic control – Analog to digital converter (ADC 0800) – Digital to analog converter (DAC 0800) – Seven segment display interfacing – Temperature measurement and control.

Introduction– Comparison between microcontroller and microprocessors - Key features of 8051 - Architecture of 8051 – Instruction set of 8051 – Assembly language programming – Sum of 'n' numbers - biggest and smallest in an array - Ascending and descending order program in an array – Software time delay.

**Books for Study and References:**

1. Microprocessor Architecture, Programming and Applications with 8085, Ramesh S. Gaonkar, III Edition, Penram International Publishing, 1997.
2. Fundamentals of Microprocessor and Microcomputers, B. Ram, V Edition, Dhanpat Rai publications (P) Ltd. New Delhi, 2003.
3. The 8051 Microcontroller – Architecture, Programming & Applications, Kenneth J. Ayala, II Edition., Penram International, India, 1996.



**Credit : 5**  
**Maximum Hours : 60**

## NUCLEAR AND PARTICLE PHYSICS

**PAPER CODE: 18P4PH10**

**Subject Description:** This paper presents the key topics in nuclear and particle physics including the standard model, properties of nuclei and nuclear models, radioactive decay and nuclear reactions.

**Goal:** To enable students to describe and explain key concepts in nuclear and particle physics, provide them with the problem solving skills required to address questions in nuclear and particle physics.

### **Objectives**

To acquire knowledge and apply it to

- explain central concepts, laws and models in nuclear and particle physics
- interpret basic experiments
- use basic laws and relations to solve simple problems

### **UNIT I NUCLEAR MODELS**

**5%**

**12**

Nuclear size, shape and distribution of charge – spin and **magnetic moment** – determination of nuclear mass – binding energy – semiempirical mass formula – nuclear stability - Liquid drop model – **Bohr-Wheeler theory of fission –Shell Model – Evidence for Magic numbers** – prediction of Shell-model- Optical Model – Collective model of Bohr and Mottelson.

### **UNIT II NUCLEAR REACTIONS**

**10%**

**12**

Nuclear reactions and reaction mechanism, Types of reactions and conservation laws – Energetics of nuclear reactions – **Dynamics 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- **Resonance scattering** – Breit-Wigner one level formula- continuum theory of nuclear reaction.

### **UNIT III NUCLEAR INTERACTIONS**

**12**

Nature of Nuclear forces – Exchange forces - Two body problem – ground state of deuteron - Magnetic moment – quadrupole 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 – Charge independence and charge symmetry of nuclear forces – Isospin formalism.

### **UNIT IV NUCLEAR DECAY**

**12**

Gamow's theory of alpha decay & Fermi's theory of beta decay – Total decay rate - Mass of the neutrino – Angular momentum and parity selection rules – Allowed and forbidden decays –

Comparative half-lives – Neutrino physics Neutrino Hypothesis – Helicity – Non-conservation of parity – Multipole transitions in nuclei – Angular momentum and parity selection rules – Internal conversion – Nuclear isomerism.

## UNIT V ELEMENTARY PARTICLE PHYSICS

20%

12

Types of interaction between elementary particles – Hadrons and leptons – Symmetries and conservation laws – Elementary ideas of CP and CPT invariance – **Classification of hadrons** – SU(2) and SU(3) multiplets **CPT Violation in neutral k-meson decay** – Gellman – nishijima formula- **Quark model** - Gell-Mann-Okubo mass formula for octet and decuplet hadrons – **Charm, bottom and top quarks .parity non conservation in weak interactions**. Relativistic kinematics, **Quantum Chromo Dynamics (QCD).**

### Books for Study and References:

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.
3. M.L. Pandya and R.P.S. Yadav, Elements of Nuclear Physics 7th edition, Kedar Nath Ram Nath, Delhi, 2003.
4. H. A. Enge, Introduction to Nuclear Physics, Addison-Wesley, Tokyo , 2006.
5. Y. R. Waghmare, Introductory Nuclear, Physics, Oxford-IBH, New Delhi, 2006.
6. Ghoshal, Atomic and Nuclear Physics, Vol. 2 , 2008.
7. B. L. Cohen, Concepts of Nuclear Physics, TMH, New Delhi , 2006.

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ADDED

VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN  
(AUTONOMOUS)  
ELAYAMPALAYAM, TIRUCHENGODE

Credit : 5  
Maximum Hours : 60

## NUCLEAR AND PARTICLE PHYSICS

PAPER CODE: 20P4PH10

**Subject Description:** This paper presents the key topics in nuclear and particle physics including the standard model, properties of nuclei and nuclear models, radioactive decay and nuclear reactions.

**Goal:** To enable students to describe and explain key concepts in nuclear and particle physics, provide them with the problem solving skills required to address questions in nuclear and particle physics.

### Objectives

To acquire knowledge and apply it to

- explain central concepts, laws and models in nuclear and particle physics
- interpret basic experiments
- use basic laws and relations to solve simple problems

### UNIT I NUCLEAR MODELS 15% 12

**Basic nuclear properties:** Size, shape and charge distribution-spin and parity- determination of nuclear mass-binding energy-semi empirical mass formula-nuclear stability- Mass Parabola- Liquid drop model-Shell Model-Prediction of Magic numbers and energy levels by shell model- Optical Model - Collective model of Bohr and Mottelson.

### UNIT II NUCLEAR REACTIONS 5% 12

Nuclear reactions and reaction mechanism, Types of reactions and conservation laws – Reciprocity theorem- Energetics of nuclear reactions-Q-value equation-Scattering and reaction cross sections- Compound nucleus reactions-Direct reactions Stripping, Pick up reactions- Partial Wave analysis of nuclear reaction cross-section-Breit-Wigner one level formula-continuum theory of nuclear reaction.

### UNIT III NUCLEAR INTERACTIONS 12

Nature of Nuclear forces-Exchange forces-Two body problem-ground state of deuteron- Magnetic moment-Quadrupole 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-Charge independence and charge symmetry of nuclear forces – Iso spin formalism.

### UNIT IV NUCLEAR DECAY 10% 12

Gamow's theory of alpha decay & Fermi's theory of beta decay -Total decay rate-Mass of the neutrino-Angular momentum and parity selection rules-Allowed and forbidden decays –

Comparative half-lives-Neutrino Hypothesis-Helicity-Non-conservation of parity-Multipole transitions in nuclei-Internal conversion-Nuclear isomerism

## UNIT V ELEMENTARY PARTICLE PHYSICS

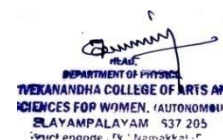
10%

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 interaction.

### Books for Study and References:

- 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.
- 3.M.L. Pandya and R.P.S. Yadav, Elements of Nuclear Physics 7th edition, Kedar Nath Ram Nath, Delhi, 2003.
- 4.H. A. Enge, Introduction to Nuclear Physics, Addison-Wesley, Tokyo , 2006.
- 5.Y. R. Waghmare, Introductory Nuclear, Physics, Oxford-IBH, New Delhi, 2006.
- 6.Ghoshal, Atomic and Nuclear Physics, Vol. 2 , 2008.
- 7.B. L. Cohen, Concepts of Nuclear Physics, TMH, New Delhi , 2006.



Credit: 5

Max. Hours: 60

## COMMUNICATION SYSTEMS

PAPER CODE: 18P4PH11

**Subject Description:** This paper presents the fundamentals electronics communication systems.

**Goal:** To enable the students to acquire the knowledge about the types of communication systems, elements used in communication systems and modes of communications.

### Objectives

To acquire knowledge about

- The working principles of communication systems.
- How to handle the communication elements.

### UNIT I MODULATION SYSTEMS

10%

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

5%

12

Basics of Fiber Optics- Classification- Single mode and multimode, Step index and Graded index. Acceptance angle, Numerical Aperture, Fiber Losses- Attenuation, Absorption, Leaky modes, Bending losses, Transmission losses, and Core and cladding losses. Chromatic and modal dispersion. Splicing and connectors.

### UNIT III MICROWAVE COMMUNICATION SYSTEM

15%

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, Digital Radio Systems, Hybrid Microwave systems.

### UNIT IV SATELLITE COMMUNICATIONS

5%

12

Orbital Satellites, Geostationary Satellites, Orbital Patterns, Look angles, Orbital Classifications, Spacing and frequency allocation, Radiation Pattern, foot prints, satellite system

link models, satellite system link equation..Non-ideal system parameters. INSAT communications satellites. **Multiple Accessing Frequency Hopping**, Channel Capacity. RADAR.

## UNIT V MOBILE COMMUNICATION

**5%**

12

Evaluation and fundamentals – cellular structure and planning – frequency allocations – propagation problems – Base station antennas and mobile antennas – type of mobile system – access methods – TDMA, FDMA and CDMA – **DIGITAL Cellular Radio**.

### Books for Study and References:

1. Taub and Schilling, Principles of Communication Systems, Second edition, Tata Mc Graw Hill, 2010, 3<sup>rd</sup> edition.
2. Simon Haykin, Communication system, Third edition John Wiley & Sons, Inc.2007, 4<sup>th</sup> Edition.
3. Wayne Tomasi, Advanced electronics communication systems, fourth edition, Prentice Hall, Inc., 2005, 6<sup>th</sup> edition.
4. Dennis Roddy, Satellite Communications, Second edition, Mc graw Hill, 2006, 4<sup>th</sup> edition.
5. John M. Senior, Optical Fiber Communications, Second Edition, PHI, 2009, 6<sup>th</sup> Edition.
6. Electronic Communication Systems –George Kennedy& Davis, Tata McGraw Hill, 2006, 4<sup>th</sup> Edition.
7. Wireless Communication Principles & Practice – TS. Rapport.
8. Wayne, Electronic Communication Systems, 2004, 6<sup>th</sup> Edition.

2020

NO CHANGE

VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN  
(AUTONOMOUS)  
ELAYAMPALAYAM, TIRUCHENGODE

Credit: 5

Max. Hours: 60

## COMMUNICATION SYSTEMS

PAPER CODE: 20P4PH11

**Subject Description:** This paper presents the fundamentals electronics communication systems.

**Goal:** To enable the students to acquire the knowledge about the types of communication systems, elements used in communication systems and modes of communications.

### Objectives

To acquire knowledge about

- The working principles of communication systems.
- How to handle the communication elements.

### UNIT I MODULATION SYSTEMS

12

Theory of Amplitude modulation - frequency modulation - phase modulation - Pulse code modulation - Pulse width modulation - Sampling theorem - low pass and band pass signals, PAM, Differential PCM delta modulation - Delta modulation - Adaptive Delta modulation - BPSK, QPSK.

### UNIT II FIBER OPTICS COMMUNICATION

12

Basics principle of Fiber Optics – Classification - Single mode and multimode, Step index and Graded index - Fiber Losses - Attenuation, Absorption, Leaky modes, Bending losses, Transmission losses, and Core and cladding losses.

Propagation of Light in an Optical Fiber: Acceptance Angle – Numerical Aperture – Dispersion – Applications.

### UNIT III MICROWAVE COMMUNICATION SYSTEM

12

Microwave Generation - Multicavity Klystron - Reflex Klystron - Magnetron - Travelling Wave Tubes (TWT) – MASER - Microwave communication system - Analog Microwave Communication - LOS microwave system - OTH microwave system - Digital Hierarchies, Digital Microwave Systems, Bandwidth efficiency.

### UNIT IV SATELLITE COMMUNICATIONS

12

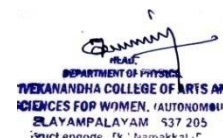
Orbital Satellites, Geostationary Satellites, Orbital Patterns, Look angles, Orbital Classifications, Spacing and frequency allocation, Radiation Pattern, foot prints, Satellite System link models, Satellite system link equation - Non-ideal system parameters - INSAT communications satellites - Channel Capacity – RADAR- Elements of a Radar System – Radar Equation - Cable TV, CCTV and Theatre TV.

## UNIT V MOBILE COMMUNICATION.

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.

### Books for Study and References:

1. Taub and Schilling, Principles of Communication Systems, Second edition, Tata Mc Graw Hill, 2010, 3<sup>rd</sup> edition.
2. Simon Haykin, Communication system, Third edition John Wiley & Sons, Inc.2007, 4<sup>th</sup> Edition.
3. Wayne Tomasi, Advanced electronics communication systems, fourth edition, Prentice Hall, Inc., 2005, 6<sup>th</sup> edition.
4. Dennis Roddy, Satellite Communications, Second edition, Mc graw Hill, 2006, 4<sup>th</sup> edition.
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6. Electronic Communication Systems –George Kennedy& Davis, Tata McGraw Hill, 2006, 4<sup>th</sup> Edition.
7. Wireless Communication Principles & Practice – TS. Rapport.
8. Wayne, Electronic Communication Systems, 2004, 6<sup>th</sup> Edition.



**THIN FILM PHYSICS**

**PAPER CODE: 18P4PHE03**

**Subject Description:** This paper presents the preparation of thin film and its various properties.

**Goal:** To enable the students to acquire the knowledge about the various coating, its thickness measurements and its influence on the properties of thin films.

**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.

**Unit I Preparation of Thin Films**

**20%**

**14**

Study of thin film vacuum coating unit - Physical vapour deposition – Thermal evaporation – electron beam evaporation – Sputtering **Study of glow Discharge** **Physical nature of sputtering** - **Sputtering yield** **Experimental set up for DC and RF magnetron sputtering**, Pulsed laser deposition and Ion beam assisted deposition. Chemical vapour deposition – Thermodynamics of **CVD - Atmospheric pressure CVD** – MOCVD and PECVD processes. Chemical methods: **Qualitative study of preparation of thin films by Electroplating, vapour phase growth and anodization**

Nucleation and growth: Nucleation and growth of thin films – **four stages of film growth** - Directionality of evaporation molecules - **Cosine law of emission. Emission from a point source.** **Mass of material condensing on the substrate.**

**Unit II Deposition Monitoring and Control:**

**5%**

**8**

**Microbalance**, Crystal oscillator thickness monitor, optical monitor, Resistance Monitor. Thickness measurement: Multiple Beam Interferometer, Fizeau (Tolansky) technique - Fringes of equal chromatic order (FECO) method - Ellipsometry (qualitative only). (8)

**Unit III Electrical properties**

**10%**

**7**

Sheet resistance - size effect - Electrical conduction in thin metallic films. **Effect of ageing and annealing - Oxidation - Agglomeration.**

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, Optical constants of thin films – spectrophotometer- Transmittance, absorption, determination of band gap.

**Unit V Application of Thin Films****10%****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 – antireflection coatings.

**Books for Study and References:**

- 1 . Hand book of Thin films Technology : L I Maissel and R Clang .
- 2 . Thin film Phenomena : K L Chopra .
- 3 . Physics of thin films, vol. 12 , Ed George Hass and others .
- 4 . Thin films solar cells – K L Chopra and S R Das .
- 5 . Thin films processes – J L vilsan
- 6 . vacuum deposition of thin films – L Holland .
- 7 . The use of thin films in physical investigation – J C Anderson .
- 8 . Thin films technology – Berry, Koil and Harris.

**THIN FILM TECHNOLOGY**

**PAPER CODE: 20P4PHE03**

**Subject Description:** This paper presents the preparation of thin film and its various properties.

**Goal:** To enable the students to acquire the knowledge about the various coating, its thickness measurements and its influence on the properties of thin films.

**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.

**Unit I THIN FILM FORMATION METHODS**

**25%**

**12**

**Basics of thin film: Nucleation and growth of thinfilms. Vacuum coating unit: Construction and uses of vapor sources – wire - crucible vacuum pumps and heated sources – measurement of Pressure – gauges.**

Thin film preparation methods: Physical vapor deposition (PVD) - Thermal evaporation; electron beam evaporation - Pulsed laser deposition; Ion beam assisted deposition - Chemical vapor deposition (CVD) - MOCVD and PECVD processes - Chemical methods.

**Unit II Deposition Monitoring and Control**

**8**

Electrical methods: Quartz crystal monitor; Crystal oscillator thickness monitor-ResistanceMonitor.

Optical methods: Multiple Beam Interferometer, Fizeau - Tolansky technique - Fringes of equal chromatic order (FECO) method –Ellipsometry.

**Unit III Electrical properties**

**5%**

**8**

Influence of thickness on resistivity - Electrical conduction in thin metallic films - Resistivity of the metallic film - Sheet resistance - Hall effect - **Calculation of mobility** - DC conduction mechanism - Low field and high field conduction. - AC conduction mechanism.

Temperature dependence of conductivity - Thermal treatment process: Breakdown mechanism in dielectric films.

#### Unit IV Structural analysis:

5%

11

X-ray diffraction – powder diffraction - determination of lattice parameters-structure - X-ray photoelectron spectroscopy (XPS) -Infra red spectroscopy (IR) – Raman spectra(RS).

**Optical analysis:** Optical constants of thin films – calculation of particle size - UV spectrophotometer - Transmittance, absorption, determination of band gap.

**Surface analysis:** Field Emission scanning Electron microscope (FESEM) - Transmission electron microscopy (TEM) - Atomic force microscopy (AFM )

#### Unit V Application of Thin Films

9

Thin film resistors: Materials and Design of thin film resistors. Thin film capacitors:

Materials - Capacitor structures-Capacitor yield and capacitor stability.

Fabrication and characteristics: Thin film field effect transistors - Thin film solar cells - anti reflection coatings.

#### Books for Study and References:

- 1 . Hand book of Thin films Technology : L I Maissel and R Clang .
- 2 . Thin film Phenomena : K L Chopra .
- 3 . Physics of thin films, vol. 12 , Ed George Hass and others .
- 4 . Thin films solar cells – K L Chopra and S R Das .
- 5 . Thin films processes – J L vilsan
- 6 . vacuum deposition of thin films – L Holland .
- 7 . The use of thin films in physical investigation – J C Anderson .
- 8 . Thin films technology – Berry, Koil and Harris.

2019

DELETION

VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN  
(AUTONOMOUS)  
ELAYAMPALAYAM, TIRUCHENGODE

Credit: 4  
Max. Hours: 45

EDC: SOLAR ENERGY

Paper Code: 18P3PHED1

**Subject Description:** This paper gives an idea about energy production, storage and conservation systems.

**Goal:** To enable the students to aware about renewable energy types, energy resources and conservation of energy.

**Objectives:** To acquire knowledge about

- Energy resources around us.
- Threatening to our energy resources.
- How to conserve energy.

**UNIT I INTRODUCTION TO ENERGY SOURCES** **12**

Classification of Energy sources, Worlds reserve of commercial energy sources and their availability-Geothermal energy-wind energy-ocean thermal energy conversion-energy from waves and tides(basic ideas)-merits and demerits.

**UNIT II SOLAR THERMAL ENERGY** **12**

Renewable energy sources-solar energy-solar water heater-solar space heating and cooling- solar thermal technologies-solar cooker-merits and demerits of solar energy.

**UNIT III SOLAR CELL** **12**

Photo voltaic effect - performance of cell-choice of materials for solar cells-Basic requirements for obtaining an effective solar cell-PV power generation.

**UNIT IV BIOMASS ENERGY FUNDAMENTALS** **12**

**Conservation of energy patterns of energy consumption in domestic industrial, transportation and Agriculture sector** - Biomass energy – classification - Photosynthesis- Biomass conversion technology-advantages and disadvantages of biomass as an energy **source-Gobar gas plants**.

**UNIT V ENERGY STORAGE** **12**

Conservation of energy-Patterns of Energy consumption in domestic, Industrial, transportation-and agricultural sectors- conservation principles in these sectors.

**Books for Study and References:**

1. G.D .Rai, Solar energy utilization,Ed, 2011, 5<sup>th</sup> Edition.
2. S.P.Sukhatme,Solar energy,Tata McGraw Hill Publishing company,Ed.,2005, 3<sup>rd</sup> Edition.
3. G.D .Rai,Non Convantional Energy Sources,Ed.IV, 2011, 5<sup>th</sup> Edition.
4. D.S. Chauhan,S.K. Srivastava, Non Convantional Energy Sources,Ed.V, 2004, first edition.

**EDC: SOLAR ENERGY**

**Paper Code: 20P3PHED1**

**Subject Description:** This paper gives an idea about energy production, storage and conservation systems.

**Goal:** To enable the students to aware about renewable energy types, energy resources and conservation of energy.

**Objectives:** To acquire knowledge about

- Energy resources around us.
- Threatening to our energy resources.
- How to conserve energy.

**UNIT I INTRODUCTION TO ENERGY SOURCES 12**

Classification of Energy sources - Worlds reserve of commercial energy sources and their availability - Geothermal energy - wind energy - Ocean thermal energy conversion - Energy from waves and tides (basic ideas) - Merits and Demerits.

**UNIT II SOLAR THERMAL ENERGY 5% 12**

Renewable energy sources - Solar energy - Solar water heater - Solar pumping, Solar furnace. Solar space heating and cooling - Solar thermal technologies - Solar cooker - Solar Pond - Merits and Demerits of solar energy.

**UNIT III SOLAR CELL 10% 12**

Photo voltaic effect - Performance of solar cell - Solar cell parameter - Solar cell characteristics and efficiency - Choice of materials for solar cell - Basic requirements for obtaining an effective solar cell - Power generation by using solar cell.

**UNIT IV BIOMASS ENERGY FUNDAMENTALS 12**

Biomass energy - Classification - Photosynthesis - Biogas generation - Introduction basic process and energetic, Advantages - Biomass conversion technology - Wet and dry process - waste Gobar gas and its Applications - Advantages and Disadvantages of biomass energy.

**UNIT V ENERGY STORAGE 20% 12**

Introduction - Liquid media storage - Solid media storage - Ground collector - Chemical storage - Capacitor, Electromagnets - Superconducting Magnet Energy Storage (SMES) systems.

**Books for Study and References:**

1. G.D .Rai, Solar energy utilization, Ed, 2011, 5<sup>th</sup> Edition.
2. S.P. Sukhatme, Solar energy, Tata McGraw Hill Publishing company, Ed., 2005, 3<sup>rd</sup> Edition.
3. G.D .Rai, Non Conventional Energy Sources, Ed. IV, 2011, 5<sup>th</sup> Edition.
4. D.S. Chauhan, S.K. Srivastava, Non Conventional Energy Sources, Ed. V, 2004, first edition.

VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN  
(AUTONOMOUS)  
ELAYAMPALAYAM, TIRUCHENGODE

Credit: 4

Max. Hours: 48

PRACTICAL – III  
MICROPROCESSOR

Paper Code: 18P4PHP03

5%

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

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ADDED

VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN  
(AUTONOMOUS)  
ELAYAMPALAYAM, TIRUCHENGODE

Credit: 4

Max. Hours: 48

**PRACTICAL – III**  
**MICROPROCESSOR**

Paper Code: 20P4PHP03

1.8 Bit Decimal Addition and Subtraction.

2.Number Conversion: BCD to Binary, Binary to BCD, ASCII to Hexadecimal/Decimal,  
Hexadecimal to ASCII

3.16 bit Addition ,Subtraction,

4.16 bit Multiplication and Division

5.16 bit Square root of a number, and Square of a number

6.Sum of simple series and Factorial of a number

7.ADC interfacing

8.Stepper motor interfacing

9.Interfacing of an 8 bit DAC Converter and Waveform generation-Triangular, Saw tooth, Sine,  
Square, Rectangular

10.Traffic light controller


11.Finding the Largest/Smallest number in a data array

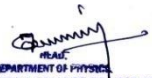
12. Find the arranging a series of numbers in ascending/descending order.

13.Multibyte decimal addition

14.Data transfer Program

15. Multi-byte Addition and Subtraction.

  
PRINCIPAL  
VIVEKANANDHA COLLEGE OF ARTS AND  
SCIENCES FOR WOMEN (Autonomous)  
ELAYAMPALAYAM - 637 205  
TIRUCHENGODE TK, NAMAKKAL DT  
TAMIL NADU

  
HEAD  
DEPARTMENT OF PHYSICS  
VIVEKANANDHA COLLEGE OF ARTS AND  
SCIENCES FOR WOMEN (AUTONOMOUS)  
ELAYAMPALAYAM - 637 205  
Tiruchengode - Tamil Nadu