DEPARTMENT OF PHYSICS
H.H.THE RAJAH'S COLLEGE(AUTO)
PUDUKKOTTAI – 622 001

COURSE STRUCTURE
AND
SYLLABI
FOR PG PROGRAMME

CHOICE BASED CREDIT SYSTEM
(2018 – 2019 ONWARDS)

H.H. THE RAJAH'S COLLEGE (AUTONOMOUS), PUDUKKOTTAI
M. Sc. Physics Programme Pattern – CBCS 2018-2019 Onwards

Sl. No.	Sem	Paper	Hrs/week	Credit	Exam hrs.	Marks		
						Internal	External	Total
1	I	Mathematical Physics - I	6	6	3	25	75	100
2	I	Classical Dynamics	6	6	3	25	75	100
	I	General Physics Practical -I*	4					
	I	Electronics Practical - II *	4					
3	I	Elective - I : Electronics and Communication	6	5	3	25	75	100
4	II	General Physics Practical-I *	4	4	4	40	60	100
5	II	Electronics Practical-II*	4	4	4	40	60	100
6	II	Mathematical Physics - II	6	5	3	25	75	100
7	II	Quantum Mechanics	6	5	3	25	75	100
8	II	Elective - II : Crystal Growth, Thin film and Nano Physics	6	5	3	25	75	100
9	II	EDC: Numerical Methods and C++ Programming	6	5	3	25	75	100
10	III	Statistical Mechanics	6	5	3	25	75	100
11	III	Electromagnetic Theory	6	5	3	25	75	100
12	III	Atomic and Molecular Physics	6	5	3	25	75	100
13	III	Elective - III; Microprocessor and Microcontroller	6	5	3	25	75	100
	III	Practical -III :Computer, Microprocessor and Microcontroller Experiments*	4					
14	IV	Practical -III :Computer, Microprocessor and Microcontroller Experiments*	4	4	4	40	60	100
15	IV	Nonlinear Dynamics and Relativity	6	5	3	25	75	100
16	IV	Condensed Matter Physics	6	5	3	25	75	100
17	IV	Nuclear and Particle Physics	6	5	3	25	75	100
18	IV	Project Work		6		20	80	100
				90				1800

* Exams will be held at the end of even semester

M. Sc. Physics 2018-2019 onwards

Program Educational Objectives (PEOs)

The **M. Sc. Physics** program describe accomplishments that graduates are expected to attain within five to seven years after graduation	
PEO1	Graduates will become experts in various professional zones like industry, research, academic, business, etc. at par with national and international standards
PEO2	Acquired knowledge in physical concepts facilitate the graduates to recognize, formulate, examine, explore and implement the ideas for societal developments
PEO3	Graduates capable enough to meet any challenge as an individual or in a part of team towards achieving prospective scope in innovative projects.
PEO4	Graduates will have cognitive base to achieve academic excellence by learning diverse phenomena of physical concepts help them to lead and execute inter- and multidisciplinary academic and research works
PEO5	Graduates will be skilled enough to perceive novel and innovative concepts to develop cutting edge technologies as entrepreneurial pursuit.
PEO6	Graduates will have a proficiency to enhance the application prospects of physics by interfacing the philosophical concepts with suitable perceptions beyond the subject boundary

M. Sc. Physics 2018-2019 onwards

Program Specific Outcomes (PSOs)

After the successful completion of **M.Sc., Physics** program, the students are expected to	
PSO1	Be a potential graduate with the stuff of vibrant subject knowledge in every subdivision of Physics especially in Classical Mechanics, Quantum Mechanics, Mathematical Physics, Nuclear Physics, Electronics and Materials Science with application tendency.
PSO2	Be a science person to extend the application of Physics discipline to different sectors of common or needy people.
PSO3	Have the competence to get clear any comprehensive examination offers superior opportunity in official, academic and research sectors
PSO4	Have the skill to manage computational tools to explore scientific activity even at subatomic particle level using theoretical concepts without empirical approach.
PSO5	Be a skillful to perceive rare or exceptional scientific phenomena using the concepts of physical science and to find solution to any challengeable task.
PSO6	Be an efficient to employ research work by applying the subject knowledge acquired from diverse objectives of Physics.
PSO7	Have the ability to meet any employment challenge demands intense subject proficiency.

M. Sc. Physics 2018-2019onwards

Program Outcomes (POs)

On successful completion of the M. Sc. Physics program	
PO1	Understand the concepts of advanced physics and capable to apply them in real time problems to find appropriate solutions
PO2	Develop model and analyse to derive solution using the background of theoretical physics.
PO3	Augment the application feasibility of Physics theoretical formulations in combination with relative concepts belongs to other discipline.
PO4	Apply learned experimental skill to develop newer materials with unique characteristics employing variety of synthesis techniques
PO5	Develop software tools by applying the learned concepts in combination belongs to Mathematical physics, Quantum mechanics and computational physics.
PO6	Perceive novel and contemporary research philosophies globally facilitate to work at par with international standards
PO7	Meet any challenge globally for employment in academic, research and industry by exposing the learned skill in diverse zone under Physics discipline.

CC01 : MATHEMATICAL PHYSICS – I

SUB.CODE: 18PPH1

Course Objectives:

The main objectives of this course are,

1. to understand the need of mathematics to gain knowledge in physics.
2. to acquire knowledge about linear vector spaces,tensors and their application in physics .3. to enhance the physically relevant problem solving techniques skills using matrices.
4. to study the connection between differential equations and their contribution in the study of dynamics.
5. to distinguish between the dynamics obtained by ordinary differential equations and partial differential equations.

UNIT – I: Vector Analysis

The Scalar and Vector fields –Differential operators in terms of orthogonal curvilinier co-ordinates (Gradient,Divergence,Curl and Laplacian)-Differential operators in terms of special curvilinier co-ordinates(Rectangular,cylindrical and spherical polar)– Integration of Vector – Line integrals, surface integrals and volume integrals – Gauss Divergence theorem – Stokes theorem – Greens theorem.

UNIT – II: Matrices and Linear Vector spaces

Orthogonal, Unitary and Hermitian matrices and skew Hermitian matrices - Characteristics equation of a matrix- Eigenvalues and eigenvector – Cayley – Hamilton theorem – Inverse of a square matrix – Diagonalization –.Important of Eigen value &Eigen vectors

Linear Vector space – Definition–Linear independence, Basis and Dimension– Scalar product – Orthonormal sets - Gram-Schmidt's orthogonalization – Schwartz inequality.

UNIT – III: Tensor Analysis

Definition – Co-ordinate transformation – Indicial and summation conventions - Kronecker delta symbol – Scalar, Covariant, Contravariant and invariant tensors – Tensors of higher Ranks – Algebraic operations of tensor - Symmetric and antisymmetric tensor – Conjugate Tensors - Metric tensor – Riemannian Spaces – Christofell's three index symbols – Law of transformation for Christofell's symbols.

UNIT – IV: Ordinary Differential Equations

Linear first order differential equations - Linear second order differential equations with constant coefficients – Linear second order differential equations with variable coefficients - Power Series solution around a regular singular point: Frobenius method – Nonlinear differential equations – Solution for anharmonic oscillator problem.

UNIT – V: Partial Differential Equations

Linear Partial differential equations – Separation of variables – Separation of Helmholtz equation in Cartesian coordinates – Laplace's equation in Cartesian, Spherical polar and Cylindrical polar coordinates – Symmetry and separability -.One dimentional & Two dimentional heat flow equation.

Course Outcomes:

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

1. understand the contibution of mathematics for gaining knowledge in physics.
2. acquire knowledge about linear vector spaces and tensors and their application in physics.
3. enhance the physically relevant problem solving techniques skills using matrices.
4. establish the connection between differential equations and their contribution in the study of dynamics.
5..classify the differential equations and choose right method to solve problems.

Books for study and Reference:

1. B.D.Gupta, Mathematical Physics, Vikas publishing ltd, India.
2. Satya Prakash, Mathematical Physics, Sultan Chand & Sons, New Delhi.
3. P.K.Chattopadhyay, Mathematical Physics (New Age international, New Delhi, 1990)
4. A.W.Joshi, Matrices and Tensors in Physics ((Wiley Eastern),New Age international New Delhi, 1995)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

https://nptel.ac.in/course.html/Physics/Integrals and vector calculus

https://nptel.ac.in/course.html/Physics/Matrix analysis and with applications

https://nptel.ac.in/courses/115/106/115106086

Mapping with programme outcomes 18PPH1							
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	6	9	9
CO3	9	9	9	9	9	3	9
CO4	9	9	6	9	9	9	9
CO5	9	9	9	6	3	9	3
Total	45	45	42	42	36	39	39
Weightage	**5.56**	**5.56**	**5.96**	**6.14**	**5.48**	**5.56**	**6.10**

Strong(9); M-Medium(6); L-Low(3).

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CC02 : CLASSICAL DYNAMICS

SUB.CODE: 18PPH2

Course Objectives:
The main objectives of this course are,

1. To understand the Lagrangian formulation of mechanics.
2. To acquire knowledge about the dynamics many body problems.
3. To analysis of the classical scattering theory.
4. To study the dynamics associated with the rigid bodies including symmetric top.
5. To understand the Hamilton Jacobi theory and Poisson bracket formalism.

UNIT – I: Lagrangian Mechanics

Mechanics of a system of particles – Constraints – Principle of virtual work- D'Alembert's principle – Derivation of Lagrange's equation for velocity independent potentials from it – Principle of least action –Derivation of Lagrange's equation from it - Simple applications of Lagrange's equation of equation– Motion of single particle in Cartesian and polar coordinates- Atwoods machine – Cyclic coordinates.

UNIT – II: Problem of Central forces

Reduction of two body problem to the equivalent one body problem- Reduced mass – Equations of motions and first integrals – Classification of orbits – Virial theorem – Differential equation for the orbit – Bertrand's theorem – Kepler problem – Motion in time in Kepler problem – The Laplace – Runge lenz vector – Scattering in a central force field – Scattering cross section – Scattering problem in laboratory coordinates. Centre of mass frames.

UNIT – III: Rigid body dynamics

Orthogonal transformations – Transformation matrix – Euler angles – stability analysis – Cayley Klein parameters – Finite and infinitesimal rotations – Corolis effect – Non inertial frame – Inertial tensor and moment of inertia – Principle axis transformation – Euler equations of motion – periodic motion – Normal modes- Motion of heavy symmetric top with one point fixed.

UNIT – IV: Small oscillations

Formulation of the problem – Eigen value equation and the principal axis transformation – Frequencies of free vibrations and normal coordinates – Free vibrations of a linear tri-atomic molecule – Forced vibrations and the effect of dissipative forces – Damped driven pendulum and the Josephson junction.

UNIT – V: Canonical transformations and Hamilton Jacobi theory

Equations of canonical transformation – examples of canonical transformations – the harmonic oscillator – Poisson brackets and other canonical invariants – Equation of motion in Poisson bracket Subsystem of the Hamilton Jacobi method of one degree of freedom – Hamilton Jacobi equation for Hamilton's principal function –The angular momentum an Poisson Pracket relation – Harmonic oscillator problem as an example – Hamilton equation for Hamilton's characteristic function – Action angle variables.

Course Outcomes:

On successful completion the student will able to,

1. understand the Lagrangian formulation of mechanics.
2. acquire knowledge about the dynamics many body problems.
3. analyze the classical scattering theory of many body systems in different coordinate systems.
4. know the dynamics associated with the rigid bodies including symmetric top.
5. reckon the Hamilton Jacobi theory and Poisson bracket formalism.

Books for Study and Reference:

1. H. Goldstein, C. Poole and John Safko, Classical Mechanics, 3rd Edition, (Pearson Education, New Delhi, 2004).
2. Rana and Joag, Classical Mechanics (Tata McGraw-Hill, New Delhi, 2006).

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

https://nptel.ac.in/course.html/Physics/Introduction to classical mechanics

https://nptel.ac.in/courses/122/106/122106027/

Mapping with programme outcomes 18PPH2							
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	9	9	6	9	3
CO2	9	9	3	6	9	9	9
CO3	9	9	9	9	3	9	9
CO4	9	9	9	9	9	6	9
CO5	9	9	6	6	9	9	6
Total	45	45	36	39	36	42	36
Weightage	**5.56**	**5.56**	**5.11**	**5.70**	**5.48**	**5.98**	**5.63**

***S-Strong(9); M-Medium(6); L-Low(3).**

CC03 : GENERAL PHYSICS PRACTICAL

SUB.CODE: 18PPHM3P

Course Objectives:

The main objectives of this course are

1..to give hands on training to do advanced physics experiment.
2. to make the students understand the concepts behind various physical experiments such as polarizablity of liquids, dispersive power of prism,refractive index of glass.
3. to motivate the students to apply the experimental techniques in youngs modulus of material.
4.to give exposure to measure some of the physical parameters with maximum accuracy.
5.to motivate the students to apply the experimental techniques in Transmission of heat.

LIST OF EXPERIMENTS

(ANY 15 EXPERIMENTS)

1. Determination of q,n,σ by forming elliptic fringes.
2. Determination of q,n,σ by forming hyperbolic fringes.
3. Determination of Stefan's constant.
4. Identification of Prominent lines by spectrum photograph- Iron Spectrum.
5. Identification of Prominent lines by spectrum photograph- Copper Spectrum.
6. Determination of e/m by Thomson's method.
7. Determination of Planck constant by Photo electric effect.
8. Determination of Carrier Concentration and Hall coefficient in semiconductors.
9. Determination of Magnetic susceptibility of a liquid by Guoy method.
10. Determination of Magnetic susceptibility of a powder Guoy method.
11. Determination of Magnetic susceptibility of a thin rod by Guoy method.
12. Determination of magnetic susceptibility of liquids by Quincke's method.
13. Determination of Charge of an electron by spectrometer.
14. Determination of Specific rotary power of a liquid using polarimeter.
15. Determination of thermal conductivity by Forbe's method.
16. Determination of wavelength of monochromatic source using biprism.
17. Determination of wavelength and thickness of a film using Michelson interferometer.
18. Determination of polarization of liquid (benzene) using spectrometer.
19. Determination of Rydberg constant using spectrometer.
20. Determination of resistivity by Four Probe method.
21. Laser Experiments (particle size, diameter of thin wire determination).

Expected Course outcomes:

After Passing the course the students should be able to

1.understand the concepts behind various physics experiments.
2.measure different physical parameters with maximum accuracy.
3.determine various physical constants through different physical experiments.
4.understand the practical knowledge of usage of various optical components in modern and devices and instruments.
5.establish practical knowledge and an extensive understanding of laser and non-linear optics.

Reference Books:

1.A text book of Practical Physics,M.N.Srinivasan,S.Balasubramanian,R.Ranganathan, Sultan Chand&Sons(2017).
2. Practical Physics and Electronics,C.C.Ouseph,U.J.Rao,V.Vijayendran,S.Viswanathan Publishers(2007).

Mapping with programme outcomes 18PPHM3P							
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	6	9	6	9	3
CO2	9	9	9	9	9	9	9
CO3	9	9	9	3	9	9	9
CO4	9	9	9	9	9	6	9
CO5	9	9	9	6	9	9	6
Total	45	45	42	36	42	42	36
Weightage	**5.56**	**5.56**	**5.96**	**5.26**	**6.39**	**5.98**	**5.63**

***S-Strong(9); M-Medium(6); L-Low(3).**

CC04 : ELECTRONICS PRACTICAL

SUB.CODE: 18PPHN4P

Course Objectives:

The main objectives of this course are

1..to give hands on training in the construction of simple electronics circuits.

2. to make the students understand the students understand practically the characteristics of transistors,amplifiers.

3. to motivate the students to apply the practically the characteristics of oscillators and filters.

4.to give exposure in understanding digital to analog conversion use of binary weighted an R-2R ladder.

5. to make the students understand the students understand practically the characteristics of frequency divider.

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LIST OF EXPERIMENTS

ANY 15 EXPERIMENTS

1. Design and study of monostable multivibrator (IC 555).
2. Design and study of bistable multivibrator (IC 555).
3. Characteristics of UJT.
4. Characteristics of SCR.
5. FET Amplifier.
6. Construction of dual power supply using ICs (78XX and 79XX).
7. Half and Full adder.
8. Half and Full Subtractor.
9. K- Map.
10. Operational amplifier – Waveform generators.
11. Operational amplifier – Active Filters.
12Operational amplifier – Digital to analog conversion by Binary weighted method.
13. Operational amplifier - Digital to analog conversion by R-2R ladder method.
14. Operational amplifier – Simultaneous equations.
15. Frequency divider using IC 555.
16. Design and study of Wien's oscillator (Transistor or IC).

17.Design and study of Phase shift oscillator (Transistor or IC).
18.BCD to seven segment display.
19.Astable Multivibrator by 555 timer.
20.Multiplexer and Demultiplexer.
21.One bit comparator.
22.Encoder and decoder.

Expected Course outcomes:

After Passing the course the students should be able to

1.construct simple electronics circuits
2.understand the theoretical concepts by doing experiments
3.understand the characteristics of transistors,operational amplifiers,oscillators and filters.
4.understandthe conceptual difference between analog and digital electronics.
5.apply Boolean algebra and the karnaugh map as tools in designing and to simplifying digital logic circuits.

Reference Books:

1.A text book of Practical Physics,M.N.Srinivasan,S.Balasubramanian,R.Ranganathan, Sultan Chand&Sons(2017).
2. Practical Physics and Electronics,C.C.Ouseph,U.J.Rao,V.Vijayendran,S.Viswanathan Publishers(2007).

Mapping with programme outcomes 18PPHN4P							
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	6	9	6	9	3
CO2	9	9	9	9	9	9	9
CO3	9	9	3	9	6	9	9
CO4	9	9	9	9	9	9	9
CO5	9	9	9	6	9	9	6
Total	45	45	36	42	39	45	36
Weightage	**5.56**	**5.56**	**5.11**	**6.14**	**5.94**	**6.41**	**5.63**

***S-Strong(9); M-Medium(6); L-Low(3).**

EC01 : ELECTRONICS AND COMMUNICATION

SUB.CODE: 18PPHE1

Course Objectives:

The main objectives of this course are

1.To study the basic principles of certain electronic components which have application in the field of communication.

2.To understand the basic concepts of communication and optical communication system.

3.To gain knowledge about different antennas and waves used for communication.

4.To identify different types of modulation and multiplexing formats.

5.To enable the learners to acquire the fundamental knowledge on the colour television and various colour television displays.

UNIT – I: Semiconductor Devices and linear integrated circuits

UJT – VI characteristics – Relaxation Oscillators – JFET Characterisatics – DC load line - Characteristics and application – SCR- DIAC – TRIAC.

Operational amplifiers – DC Characteristics – Basic OP-AMP Application – Instrumentation Amplifier – Digital to analog conversion using op-amps- Binary weighted resistor method – R-2R ladder method – Analog to digital conversion – Successive approximation method and counter methods - IC 555 timer - Multivibrators with 555 (Astable and Monostable).

UNIT – II: Antennas and Microwaves

Antennas – Equivalent circuit – Thin linear antenna – Nonresonant antenna – Loop antenna – Radiation fields – Polarization – Isotropic radiator – Power gain – Effective parameters of an antenna – Dipole arrayed VHF, UHF and Microwave antennas.

Microwave generation and application – Klystron – Traveling wave tubes – Microwave propagation through wave guides – HO1 and EO1 modes – Attenuators – Crystal detection – Measurement of SWR- Radar equations – Detection and ranging – Transmitters and receivers.

UNIT – III: Communication System

Introduction - Modulation – Modulation index – AM Modulation – Frequency spectrum of the AM wave – Power Relation in the AM wave – AM Transmitter – FM Modulation – Mathematical representation of FM - Directory modulated FM transmitters and detectors – Pulse modulation – Sampling theorem – pulse position modulation(PPM) – Pulse code modulation(PCM) – Pulse width modulation (PWM).

UNIT – IV: Optic fiber communication

Introduction of Optic fiber communication – Propagation within a fiber – Effect of Index profile on propagation – Modes of fibers -– Fabrication of fibers – Losses in fibers – Dispersion – Light sources for fiber optics – Photo detectors - Optic fiber communication systems.

UNIT – V: Color television

Essential of color television – Perception – Three color theory – Luminescence – Hue saturation – TV Camera – VIDICON – Luminescence signal – TV Display Tubes– Single transmission –

Modulation of color different signals – PAL of color TV systems- PAL color receiver – Block diagram – Merits and Demerits.

Course outcomes:

At the end of course,the student should be able to

1.have sufficient understanding on the basic principles of certain electronic components which have application in the field of communication.

2 Be familiar with the basic concepts of communication for optical communication system.

3.Gain of knowledge about different antennas and waves used for communication.

4.Differentiate between different types of modulation and multiplexing formats.

5.Acquire the fundamental knowledge on the colour television and various colour television displays.

Books for study and Reference

1. Roy Choudhary, Linear integrated circuits,
2. R.R Gulathi, Monochrome and color television, Wily Eastern New Delhi. (1995)
3. Dennis Roddy & John Coolen, Electronic Communication, Prentice-Hall of India PVT. Ltd
4. Louis Frenzel, Communication of Electronics.
5. George Kennedi, Electronic communication system.
6. B.L.Theraja, Basic Electronics, S.Chand & Company Ltd, New Delhi

RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]

https://nptel.ac.in/courses/115/107/115107095/

https://www.youtube.com/playlist?list=PLq-Gm0yRYwTgr7v3HhdrI_Kcc38369fw

Mapping with programme outcomes 18PPHE1							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	9	3	9	9	6
CO2	9	9	6	9	9	9	9
CO3	9	9	9	3	9	3	9
CO4	9	9	9	9	9	9	9
CO5	9	9	6	9	6	9	9
Total	45	45	39	33	42	39	42
Weightage	**5.56**	**5.56**	**5.53**	**4.82**	**6.39**	**5.56**	**6.57**

***S-Strong(9); M-Medium(6); L-Low(3).**

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CC05 : MATHEMATICAL PHYSICS - II

SUB.CODE: 18PPH5

Course Objectives:

The main objectives of this course are

1. To understand the mathematical methods which are applied in physics
2. To develop knowledge in mathematical physics and its application.
3. To enable students to formulate, interpret and draw interfaces from mathematical solutions.
4. To solving the problems that occur in various branches of physics discipline.
5. To enhance problems solving skills.

UNIT- I: Complex variables

Functions of complex variables – Differentiability - Analytic function – Cauchy – Riemann necessary conditions and polar form- Line Integrals of complex functions – Cauchy's integral theorem and integral formula – Taylor's and Laurent's Series – Residues,Poles and singularities – Cauchy's residue theorem – Liouville's theorem – Evaluation of Definite and contour integrals.

UNIT - II: Fourier series, Fourier, Laplace and Integral transforms

Fourier series – Dirichlet's conditions – sine and cosine series &Transforms – Fourier integrals – Fourier transforms and properties – Convolution theorem – Application to heat and wave equations – Laplace transform – solution of ordinary differential equation Inverse laplace transform – Convolution theorem.

UNIT - III: Green's Functions and Integral Equations

Green's functions –Proof of symmetry- properties – Methods of solutions in one dimension – Applications(Green function for poission equation and Quantum mechanical scattering problem) – Linear integral equations – Fredhelm and Volterra type – Neumann series – Eigen function expansion of green function – Applications.

UNIT - IV: Special Functions

Gamma and Beta functions –property, transformation, different form and relations — Legendre, associated Legendre, Bessel, Laugerre and Hermite differential equations and their solutions – Rodrigue formula – Generating functions – orthogonal properties of legender polynomial – recurrence relations for Jn (x).

UNIT -V: Group Theory

Basic definitions – Multiplication table – Finite and cyclic group – Subgroups, cosets and classes – Direct product groups – point groups– Homomorphism & Isomorphism – Reducible and irreducible representations – Schur's lemma – The great orthogonalitiy Theorem – Character table – C3V and D3 as examples – Elementary ideas of rotation groups.

Course outcomes:

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

1.Apply green's functions and Integral equations to physical problems
2.Solve problems on Complex analysis, Fourier series and Fourier Transforms.
3.Laplace transform and inverse transform of simple functions, properties, various related .and few applications.

4..Analyze gamma and beta functions and their application
5.Acquire knowledge about group its theorem with character table.

Books for study and reference:

1**.** B.D.Gupta, Mathematical Physics, Vikas publishing ltd, India.
2. Sathyaprakash, Mathematical Physics, Sultan Chand & Sons, New Delhi.
3. P.K.Chattopadhyay, Mathematical Physics (New Age international, New Delhi, 1990)
4. A.W.Joshi, Elements of Group Theory for Physicists, Wiley Eastern Ltd., New Delhi (1971).
5. E.Kreyszig, Advanced Engineering Mathematics, 8th edition. Wiley, NY, 1999.
6.W.W.Bell, Special Functions for Scientists and Engineers (Van Nostrand, New York, 1968).

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]

1.https://nptel.ac.in/courses/115/106/115106086/
2.https://nptel.ac.in/courses/115/103/115103036/

Mapping with programme outcomes 18PPH5							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	9	6	3	9	3
CO2	9	9	3	9	9	9	9
CO3	9	9	9	3	9	6	9
CO4	9	9	9	9	6	9	9
CO5	9	9	6	9	9	9	6
Total	45	45	36	36	36	42	36
Weightage	**5.56**	**5.56**	**5.11**	**5.26**	**5.48**	**5.98**	**5.63**

***S-Strong(9); M-Medium(6); L-Low(3).**

CC06: QUANTUM MECHANICS

SUB.CODE: 18PPH6

Course objectives:

The main objectives of this course are

1.To understand the dual nature of light and matter.

2.To gain knowledge on the application of mathematical operators to understand microscopic physics.

3.To solve problems of fundamental importance and obtain exact solutions.

4.To apply perturbation techniques for analytically unsolvable problems.

5.To differentiate between quantum theory of scattering from the classical counterpart and perceive the relativistic concepts on the wave mechanics.

UNIT – I: Basic Concepts

Inadequacy of classical mechanics concepts – Planck's postulate – De Broglie hypothesis in matter waves – Schrödinger time dependent and time independent equation – Hermitian operators and their properties – Commutator relation – Expectation values – Correspondence principle – Ehrenfest theorem - Hilbert space - Fundamental postulates of wave mechanics- Uncertainty principle – Schroedinger and Heisenberg pictures-Dirac delta function.

UNIT – II: Exactly Solvable Eigen value Problem (Bound states)

Simple Harmonic Oscillator: - Energy Eigenvalues and Eigenfunctions – Abstract operator method – Ladder operators – Eigenvalue spectrum – Eigenfunctions – Angular momentum operators - Rigid rotator – Particle in a cevalues spentral potential – Radial wave equation – Hydrogen atom – Energy eigenfunctions and eigenvalues.

UNIT – III Approximation Methods for Stationary States

Time independent perturbation theory – Non Degenerate case - Degenerate case – Time dependent perturbation and Application – Harmonic perturbation – Tunneling through a barrier- Sudden Approximation – Fermi's golden rule – Selection rule Stark effect – Two electron atoms – Variation method – Ground state energy estimation for helium atom – Upper bound theorem – Hydrogen molecule – WKB approximation – Spin – statistics Connection formula – Quantization condition – WKB solution of the radial wave equation.

UNIT – IV Scattering theory and Angular momentum

Elementary theory of scattering-Differential and total cross section – Scattering amplitude – Born approximation – Validity – Eikonal approximation – Partial wave analysis – Asymptotic form and Phase shift.

Angular momentum – matrix representation of spin angular momentum – Orbital angular momentum – Spin orbit coupling- Pauli's spin matrices – Commutation relations – Eigen values – Addition of angular momentum – Spin matrices – Clebsch Gordan coefficients – Tables of C-G coefficients – Identical particles with spin – Wigner Eckart theorem.

UNIT – V Relativistic Wave Equation

Klein Gordan equation Charge and Current densities Hydrogen like atoms – Non relativistic limit – Dirac equation – Dirac notation for state vectors- Position probability density – Dirac

matrices – Spin of Dirac particle – Significance of negative energy states – Relativistic electron in a central potential – Electron in a magnetic field – Spin magnetic moment.

Course outcomes

Upon completion of the course the student will able to,

1.have adequate knowledge on the application of mathematical operators to understand microscopic physics
2.Ability to solve problems of fundamental importance and obtain exact solutions
3.Find approximate solutions by using perturbation techniques for analytically unsolvable problems
4.Able to differentiate between quantum theory of scattering from the classical counterpart
5.reckon the relativistic concepts on the wave mechanics

Books for study and Reference

1. P.M. Mathews and K. Venkatesan, A Text book of Quantum mechanics TMH
2. Ghatak and Loganathan, Quantum mechanics , TMH
3. L.I Schiff, Quantum mechanics, Wiley

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1.https://www.youtube.com/playlist?list=PLbMVogVj5nJTDMhThY9xu2Tvg0u1RPuxO
2.https://medium.com/predict/what-is-quantum-mechanics
3.https://nptel.ac.in/courses/122/106/12034/
4.https://ocw.mit.edu/courses/physics/8quantum-physics-i-spring-2016/lecture-no

Mapping with programme outcomes 18PPH6							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	9	6	9	9	6
CO2	9	9	3	9	9	9	9
CO3	9	9	9	9	9	3	3
CO4	9	9	9	9	3	9	9
CO5	9	9	6	9	9	6	3
Total	45	45	36	42	39	36	30
Weightage	**5.56**	**5.56**	**5.11**	**6.14**	**5.94**	**5.13**	**4.69**

***S-Strong(9); M-Medium(6); L-Low(3).**

EC02 : CRYSTAL GROWTH , THIN FILMS AND NANO PHYSICS

SUB.CODE: 18PPHE2

Course objectives :

The main objectives of this course are

1.To understand the theoretical concepts involved in crystal growth, synthesizing new materials
2. To acquire knowledge about the synthesis of thin film using different techniques.
3. To understand the basic concept of nano science and techniques.
4.To gain the knowledge of different basic characterits techniques involved in nano materials.
5. To acquire knowledge of application nano materials in various fields..

Unit – I : Crystal Growth

Introduction – Crystal Growth and its importance – Nucleation – Theories of nucleation – Classical theory of nucleation – Spherical and Cylindrical shape of nucleus – Heterogeneous nucleation – Solution – Solubility and super solubility – Methods of crystallization – Slow cooling – Slow evaporation – Gel Growth – Experimental procedure – U-tube and straight tube methods – Melt Growth techniques : Bridgmann, Czochroiski – Kyropoulous methods.

Unit – II : Thin Films

Introduction – Thermodynamics of nucleation – Film Growth – Deposition parameters and grain size – Thin film structure – Substrate, Dislocation and film thickness effect – Transport properties and basic parameters – Annealing effect - Optical properties – Reflection, Transmission, Absorption and energy band gap – Electrical properties – Conductivity, Resistivity and Activation energy.

Unit – III Introduction to Nano materials

Introduction – Top down and Bottom up process – Classification – Lithographic process and its limitations – Non lithographic techniques – Plasma Arc method – Chemical vapour deposition (CVD) - Pulsed Laser deposition (PLD) – Sol-Gel technique – Electro deposition – Ball Milling.

Unit – IV Characterization tools of Nano materials

X-Ray diffraction (XRD) studies –Structural parameter analysis – X-ray Photoelectron spectroscopy (XPS) – Morphological characterization – Electron microscopy – Scanning Electron microscopy (SEM) – Scanning Tuning Microscopy (STM) – Atomic Force Microscopy (AFM) – Scanning Probe Microscopy (SPM) – Transmittance Electron microscopy (TEM).

Unit – V Carbon Nano tubes and Applications

Fabrication – Structure of CNT – Electrical, Vibrational and Mechanical properties of CNT – General applications: Colourants and Pigments – DNA array devices – Drug Delivery System.

Course outcomes:

After learning the course the students should be able to

1. To have knowledge about the synthesis of crystal growth using basic concepts.
2. To noting learner about the various techniques of thin films and nano materials.
3. To have knowledge about how to characterize the nano materials using various methods.
4 .Can acquire the knowledge that where the nano materials are applied in various fields.
5..Can acquire the knowledge that where the carbon nano tubes.

Books for Study and Reference :

1. P. Ramasamy and P. Santhana Raghavan, Crystal Growth Processes and Methods.
2. A.Goswami, Thin Film Fundamentals, New Age International publishers, New Delhi
3. K.K. Chattopadhyay, A.N. Banerjee, Introduction to Nano Science and technology, PHI Learning Pvt. Ltd, New Delhi.
4. Paras N Prasad, Nano photonics, John Wiley & Sons, Inc. New Delhi.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1.http://nptel.ac.in/courses/104104011/14.

2.https://en.wikipedia.org/wiki/Nanomaterials

Mapping with programme outcomes 18PPHE2							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	9	6	3	9	6
CO2	9	9	9	9	9	9	9
CO3	9	9	9	9	6	6	9
CO4	9	9	9	9	9	9	9
CO5	9	9	6	3	9	9	3
Total	45	45	42	36	36	42	36
Weightage	**5.56**	**5.56**	**5.96**	**5.26**	**5.48**	**5.98**	**5.63**

***S-Strong(9); M-Medium(6); L-Low(3).**

EDC : NUMERICAL METHODS AND C ++ PROGRAMMING

SUB.CODE: 18PPHED1

Course objectives:

The main objectives of this course are

1.This advanced course on scientific computing using numerical problem will focus on
2.Facilitating comprehension of object-oriented programming through C and C++ programming languages for simulating scientific problems.
3.Understanding fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
4.Enabling the handling of arrays and related operations for advanced problems and Improving scientific data plotting and analysis
5.Providing a working knowledge of practical numerical methods.

Unit – I : Numerical Methods

Newton Raphson method of root finding – Simpson 1/3 and Trapezoidal integration rules – Newton forward and backward difference formulae for derivatives – Gauss Elimination method for simultaneous equations – Runge Kutta II and IV order methods for solving Differential equations – Gregory – Newton forward and backward interpolation formula

Unit II: Object oriented Programming

Basic concepts of Object Oriented Programming – Structure of C++ Program - Tokens, Key words – Identifiers and constants – Basic Data types -User Defined Data types - Derived data types – Symbolic constants – Declaration of Variables – Dynamic Initialization of variables – operators in C++ - Scope resolution operator.

Unit III: **Expressions and Function**

Expressions and their types – Special assignment expressions – Implicit conversions – Control structures.

Functions in C++ – the main () function – function prototyping – inline functions – default arguments – constant arguments – function overloading – math library functions

Unit IV: Class and objects

Specifying a Class – defining a member function – making an outside function inline – Nesting of member function – Private member function – Arrays with in a class – Friend function – Arrays of objects – Objects as function arguments.

Unit V: Constructors, Destructors and File handling

Constructors – Parameterized constructors – Copy constructor – Destructors.

Inheritance: Single inheritance – Multiple inheritance – multi level inheritance.

Working with files – Classes for file steam operation – Opening and Closing a file – text file operation – error handling during file operation.

Course Outcome:

Upon successful completion of this course, the student will be able to:

1..Apply fundamental programming concepts in numerical problem to solve substantial scientific problems
2..Create, implement, debug, and evaluate algorithms for solving scientific problems
3.Utilize the various features of the C and C++ libraries for advanced data analysis.
4. Use high-performance tools to load, clean, transform, merge, and reshape data Create data visualizations with argument and math library function.
5.and use appropriate algorithmic approaches to solve numerical analyses problems

Books for Study and Reference:

1. E. Balagurusamy, Object oriented Programming with C++
2. Bjarne Stroutstrup, The C++ Programming Language
3. Grady Booch, Object Oriented Analysis and design.
4. M.K. Venkataraman, Numerical methods in Science & Engineering (The National Publishing co; Madras, 1993).
5. Bohn Hubbard, *Schaum's outline Series: Programming with C++, 2nd Ed.* (Tata McGraw-Hill, New Delhi, 2006)

Mapping with programme outcomes 18PPHED1							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	9	6	3	9	9
CO2	9	9	6	9	9	9	9
CO3	9	9	9	9	3	3	9
CO4	9	9	9	9	9	9	9
CO5	9	9	9	3	9	6	6
Total	45	45	42	36	33	36	42
Weightage	**5.56**	**5.56**	**5.96**	**5.26**	**5.02**	**5.13**	**6.57**

***S-Strong(9); M-Medium(6); L-Low(3).**

CC07 : STATISTICAL MECHANICS

SUB.CODE: 18PPH7

Course objectives:
The main objectives of this course are
1. To acquire knowledge about law of thermodynamics.
2. To acquire knowledge about kinetic theory of gases.
3. To link thermodynamics to the micro descriptions used in classical statistics.
4. To link thermodynamics to the micro descriptions used in quantum statistics.
5. To acquire knowledge of about Einstein's & Debye's theory.

UNIT – I Review of the Laws of Thermodynamics and Their Consequence

Energy and first Law of Thermodynamics – Heat content and Heat Capacity – Specific heat – Entropy – Second Law of Thermodynamics – Thermodynamic potential and the Reciprocity relation – Maxwell's relation – Deduction – Properties of Thermodynamics relation – Gibb's Helmholtz relation – Nernst Heat theorem of third law – Phase-Gibb's Phase rule – Chemical potential.

UNIT – II Kinetic Theory

Equilibrium state of dilute gas: Binary collisions – Boltzmann transport equation and its validity Boltzmann's H-theorem and its analysis – Maxwell-Boltzmann distribution – Method of most probable distribution.

Transport Phenomena: Mean free path – Conservation laws – Zero and first order approximation – Viscous hydrodynamics – Navier-Stoke's equation – Examples in hydrodynamics.

UNIT – III Elementary Statistical Mechanics

Micro and Macro states – Statistical equilibrium – Phase space - Partition function – Free energy – Relation between partition function and thermodynamic quantities - Ensembles – Micro canonical ensemble – Partition function and its associated thermodynamic quantities – Canonical ensemble – Partition function and its associated thermodynamic quantities - Grand canonical ensemble – Partition function and its associated thermodynamic quantities - Liouville's theorem – Maxwell-Boltzmann statistics.

UNIT – IV Statistical Mechanics of ideal Bose gas

Bose-Einstein– Distribution law - Black body radiation and Planck's law – Phonons – Partition function for a harmonic oscillator – Specific heat of Solids– Einstein's theory – Debye's theory – Specific heat of diatomic molecules – Ideal Bose gas – Energy, Pressure and Thermal properties – Bose-Einstein condensation – Liquid helium.

UNIT – V Statistical Mechanics of ideal Fermi gas

Fermi-Dirac statistics and distribution law – Ideal Fermi gas – Properties – Gas degeneracy-Electron gas – Free electron model and Thermoinic emission –– Random walk problem – Brownian Motion – Diffusion Equation.—First and second order phase transitions: Dia, Para, Ferromagnetism – Ising model.

Course outcomes:

Upon successful completion of this course, the student will be able to:

1. Student identifies the relationships of thermodynamic quantities.
2. Student uses some empirical equations of state to compute the final state of thermodynamical systems.
3. Student uses the partition function for calculations about ensembles.
4. Student uses Bose-Einstein and Fermi-Dirac statistics according spin of the particles.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]

https://nptel.ac.in/courses/115/106/115106111/

https://ocw.mit.edu/courses/physics/8-333-statistical-mechanics-i-statistical-mechanics-of-particles-fall-2013/lecture-notes/

5. Can acquire the knowledge of ideal Fermi gas.

Books for study and Reference:

1. F.Reif, Statistical and Thermal Physics, McGraw Hill, International Edition,
2. B.R.Agarwal and N.Eisnor, Statistical Mechanics, Wiley Eastern Ltd, NewDelhi.
3. R.Huang, Statistical Mechanics, Wiley Eastern Ltd, New Delhi (1983)
4. C.KIttel, Thermal Physics, 2nd Ed.
5. Gupta & Kumar, Statistical mechanics, Pragati publications.

Mapping with programme outcomes 18PPH7							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	9	6	6	6	9
CO2	9	9	6	9	9	9	9
CO3	9	9	9	3	9	3	9
CO4	9	9	9	9	9	9	9
CO5	9	9	6	9	3	6	6
Total	45	45	39	36	36	33	42
Weightage	**5.56**	**5.56**	**5.53**	**5.26**	**5.48**	**4.70**	**6.57**

***S-Strong(9); M-Medium(6); L-Low(3).**

CC08 : ELECTROMAGNETIC THEORY

SUB.CODE: 18PPH8

Course objective:

The main objectives of this course are

1.To know the associated effects of stationary and moving charges.
2.To impart knowledge on the concept of magneto statics.
3.To impart knowledge on the concept of Faraday's laws, induced emf and Maxwell's equations.
4.To impart knowledge on the concept of electromagnetic waves.
5. objective is to introduce then about wave guides and their applications.

Unit I : Electrostatics:

Coloumb's law – The electric field – Continuous charge distribution – Gauss's law and its applications – the curl of E – electric potential – Poisson and Laplace equation – the potential of the localized charge distribution – Electrostatic boundary conditions – the work done to more charge – energy of a point charge distribution – continuous charge distribution – the classic image problem – the induced surface charge – force and energy – Multipole expansion – Approximate potentials at large distances.

Unit II: Magnetostatics

The Lorentz force law – Magnetic field – Magnetic forces – Biot-savat law – steady current – the magnetic field of steady current – straight line current – the divergence and curl of B – Application of Amperee's law – comparison of electrostatics and magnetostatics - magnetic vector potential – magnetic boundary – Multi pole expansion of vector potential – Ampere's theorem – Ampere's law in magnetized materials – Magnetic susceptibility and permeability.

Unit III: Electromagnetic Induction:

Faraday's laws – induced electric field – Boundary value problem – Inductance (Neumann's formula) – Energy in a magnetic field – Maxwell's Equations:- Electrodynamics before Maxwell's – Displacement current – Maxwell's equation in a matter,-Maxwells equation in free space in linear isotropic media – Lorentz invariance of Maxwells equation - boundary conditions on the fields at interfaces – Conservation laws:- Continuity equation - Poynting theorem – Potential field:- Scalar and vector potentials - Gauge transformations and invariance – Coulomb and Lorentz Gauge – Radiation from moving charges and dipole - Retarded potential.

Unit IV: Electromagnetic waves:

Plane wave in a non-conducting media – linear and circular polarization – Energy flux in a plane wave – Radiation pressure and momentum – plane wave in a conducting medium – Reflection and refraction of electromagnetic waves at a plane interface between dielectrics – Frequency dispersion characteristics of dielectrics – Dispersion relation in plasma -Conductor and Plasma.

Unit V: Wave Guide and Radiating System

Propagation of waves between conducting planes – waves in Guides of Arbitrary cross-section (Cylindrical) – wave Guides of Rectangular cross-section – Coaxial wave guide – Dielectric wave Guide – Resonant cavities – Field and radiation of a localized oscillating source – Electric dipole field and Radiation – Magnetic dipole and electric dipole field – Center-fed linear antenna.

Course outcomes;

Upon successful completion of this course, the student will be able to:

1.Understand the basic mathematical concepts related to electromagnetic vector fields.
2. Understand the concept related to faraday's law, induced emf and Maxwell's equations.
3. Apply Maxwell's equations to solution of problem relating to transmission lines and uniform plane wave propagation.
4.The have learnt about wave guides and transmission lines.
5.Understand propagation of waves through them.

Books for Study and references:

1. David J. Griffiths, Introduction to Electrodynamics (Prentice-Hall of India, New Delhi, 1995).
2. J.D. Jackson, Classical Electrodynamics (Wiley Eastern, 1988).
3. K. K. Chopra and G.C. Agarwal, Electromagnetic theory, K. Nath & Co. Meerut 2016.
4. B.B. Laud, Elctromagnetics (New Age International Publishers).
5. John R. Reitz, Fredrick, J. Milford and Robert, W. Christy, Foundations of electromagnetic Theory.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]

https://nptel.ac.in/courses/122/106/122106034/
https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture-notes

Mapping with programme outcomes 18PPH8							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	9	6	3	9	3
CO2	9	9	6	9	9	9	9
CO3	9	9	9	9	6	6	6
CO4	9	9	9	9	9	9	9
CO5	9	9	6	9	6	9	3
Total	45	45	39	42	33	42	30
Weightage	**5.56**	**5.56**	**5.53**	**6.14**	**5.02**	**5.98**	**4.69**

***S-Strong(9); M-Medium(6); L-Low(3).**

CC09 : ATOMIC AND MOLECULAR PHYSICS

SUB.CODE: 18PPH9

Course objectives:

The main objectives of this course are

1.To acquire knowledge about the basic concept of atomic and molecular physics of the system.
2. To describe the origin of ray and emission& absorption spectra.
3. To explain the microwave and IR Spectroscopy determining of molecules.
4. To study Raman spectroscopy,principle,instrumentation and their applications.
5. To impart knowledge about the lasers,masers in real world environment.

UNIT - I: Atomic spectra

Quantum states of electron in atoms – Hydrogen atom spectrum – Electron spin – Stern Gerlach experiment – Spin-orbit interaction – Lande interval rule – Two electron systems, LS-JJ coupling schemes – Fine structure – Spectroscopic terms and selection rules – Hyperfine structure – Isotopic shift.

Exchange symmetry of wave functions – Pauli's exclusion principle – Periodic table – Alkali type spectra – Equivalent electrons – Hund's rule.

UNIT - II: Atoms in External Fields and X – Ray spectra

Zeeman and Paschen Back effect of one and two electron systems – Selection rules – Stark effect – Inner shell vacancy – X-ray- Auger transitions – Compton Effect.
Molecules: Covalent, ionic and Vanderwall's interactions – Born Oppenheimer approximation
-X – ray spectra: origin of x-rays – emissions spectra and double spectra – Absorption spectra.

UNIT - III: Microwave and IR Spectroscopy

Rotational spectra of diatomic molecules – Intensity of spectral lines – Effect of isotopic substitution – the non-rigid rotator – Rotational spectra of poly atomic molecules – linear, symmetric top and asymmetric top molecules – Experimental techniques – Vibrating diatomic molecule – Diatomic vibrating rotator – Linear and symmetric top molecules – Analysis by infrared techniques – characteristic and group frequencies.

UNIT - IV: Raman Spectroscopy and Electronic Spectroscopy of Molecules

Raman Effect – Polarizability theory – Pure rotational Raman's spectrum: vibrational Raman spectrum diatomic molecules – selection rules – Structure determination form Raman & IR spectrometer experimental Techniques.

Electronic spectra of diatomic molecules – intensity of spectral lines – The Franck-Condon principle – Dissociation energy and dissociation products - Electronic spin resonance – Nuclear magnetic resonance.

UNIT - V: Masers and Lasers

Spontaneous and stimulated emission – Ammonia maser – Interaction of radiation with atomic systems – Einsteins's coefficients – Population inversion inversion – Laser threshold condition – Rate equations for 3 and 4 level lasers – Laser resonators and coherence length – Ruby Laser – He-Ne laser – CO_2 laser, Semiconductor laser – laser applications.

Couse Outcomes:

Upon successful completion of this course, the student will be able to:

1. Analyze different atomic structure and will be able to understand fine structure and hyper fine structure.
2. Expiain the behavior of atoms in external electric and magnetic fields.
3..Explain rotational and IR Spectroscopy and apply the techniques of micro waves and IR Spectroscopy.
4. Apply the principle to Raman spectroscopy and its applications in various disciplines of science and technology.
5 .Design various types of lasers and masers system.

Books for study and reference:

1. C,N.Banwell, Fundamentals of Molecular Spectroscopy, TMH
2. A. Beiser, Concepts of Modern Physics, TMH
3. B. P. Stranghan and S. Walker, Spectroscopy Vol. 1, Chapman and Hall 1976
4. Manas Chanda, Atomic Structure and Chemical Bond, TMH
5. Vimal Kumar Jain, Introduction to molecular spectroscopy,

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites, etc.]

https://nptel.ac.in/courses/115/105/115105100/
https://onlinecourses.nptel.ac.in/noc20_cy31/preview

Mapping with programme outcomes 18PPH9							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	9	3	6	9	6
CO2	9	9	9	9	9	3	9
CO3	9	9	9	9	6	6	9
CO4	9	9	9	6	9	9	9
CO5	9	9	6	9	9	9	3
Total	45	45	42	36	39	36	36
Weightage	**5.56**	**5.56**	**5.96**	**5.26**	**5.94**	**5.13**	**5.63**

***S-Strong(9); M-Medium(6); L-Low(3).**

EC03 : MICROPROCESSOR AND MICROCONTROLLER

SUB.CODE: 18PPHE3

Course objective:

The main objectives of this course are

1. To know the internal organization ,addressing modes and instruction set of 8085 microprocessor
2. To know the various functional units of 8051 microcontroller interfacing of various peripheral devices
3. .To know the various functional units of 8051 microcontroller interfacing memory.
4. To design the architecture of 8051 microcontroller.
5. To write the simple programs for manipulating the numbers using 8051 microcontroller

Unit – I: Microprocessor Architecture (8085) and Instruction Set

Microprocessor architecture 8085 – data instruction cycle – timing diagram – Instruction set – data transfer group – arithmetic group – logic group – branch control group – I/O and machine controlled group – addressing modes – direct –indirect – register – relative – indexed modes – status flags.

Unit – II: Microprocessor Programming

Software programs – debugging – modular programming – structured programming – macros – micro programming – assembly language programming – addition – subtraction – multiplication – division – BCD arithmetic –searching an array for a given number – smallest and largest numbers from a list – arranging a list of numbers in ascending and descending order – finding the square root of a number – multibyte addition and subtraction.

Unit – III: Interfacing and Applications

Interfacing memory and I/O devices – IC mapped I/O – memory mapped I/O – Types of interfacing devices – 8255 I/O ports and programming– Applications: Water level indicator,Basic - Traffic control and stepper motor– Temperature measurements and control– Music generator

Unit – IV: Microcontroller (8051) Architecture

8051 Architecture – Microcontroller hardware – Program and data memory – External memory – Counter – Timers – Serial data I/O – Interrupts.-Interfacing external memory and I/O – Timing and controls

Unit – V: Microcontroller (8051) Instructions and Simple Programs

Addressing modes – Instructions – Data transfer instructions – Logical, arithmetic, jump and call instructions – Bit manipulation – Addition – Sum of N numbers, Multibyte addition – Subtraction – Multiplication – Division – Biggest and smallest numbers.

Course Out comes

Successful completion of this course ,student will be able to

- Understand the architecture of microprocessor and microcontroller
- Understand the programming model of microprocessors and microcontrollers
- Interface different external peripheral devices with microprocessors and microcontrollers
- Develop an assembly language programme for specified applications.

- Unterstand the simple programs for manipulated the numbers using

  8051 microcontroller

Books for study and reference:

1. B. Ram, Fundamentals of Microprocessors and micro computers (Dhanpat Rai and sons, New Delhi, 1995).
2. R. Goankar, Microprocessor Architecture Programming and Applications (Wiley Easter Ltd.,)
3. Kenneth J. Ayala, The 8051 Microcontroller, Architecture, Programming and Applications (Thompson, Delmer, Learning (ISE), New Delhi, 2004).4. Microprocessor and micro controller,(Krishna kant ,New Delh,i 2014.)

Mapping with programme outcomes 18PPHE3							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	9	6	3	9	3
CO2	9	9	9	9	9	9	9
CO3	9	9	9	3	6	3	9
CO4	9	9	9	9	9	9	9
CO5	9	9	6	9	9	6	6
Total	45	45	42	36	36	36	36
Weightage	**5.56**	**5.56**	**5.96**	**5.26**	**5.48**	**5.13**	**5.63**

***S-Strong(9); M-Medium(6); L-Low(3).**

CC10: COMPUTER , MICROPROCESSOR, MICROCONTROLLER PRACTICALS

SUB.CODE: 18PPH10P

Course objective:

The main objectives of this course are

1. to provide the student hands-on experiences in numerical rules adopted in C++ through laboratory experiments
2.to provide a working knowledge of practical numerical methods.
3.to a series of computer programs in C++ programming language on basic numerical methods will be provided.
4.Students will be asked to write programs involving various mathematical and physics problems
5. test them in the computer of numerical problem in the rules of microprosser and micro controller

LIST OF EXPERIMENTS

ANY 15 EXPERIMENTS(5 from each section)

C++

1. Newton Raphson method
2. Simpson and Trapezoidal integration rules
3. Gauss Elimination method
4. Runge Kutta II and IV order methods
5. Newtons Forward and backward formulae
6. Bifurcation diagram of logistic map
7. Duffing Oscillator trajectory plot

MICROPROCESSOR

1. Addition, subtraction, multiplication and divison (8 bit)
2. 16 bit addition and 1's and two's complement subtraction(8 and 16 bit)
3. Conversion : Decimal to Octal and Decimal to hexadecimal
4. Searching for a number from a given list
5. Ascending and descending order
6. Stepper motor interface
7. Temperature measurement interface

MICROCONTROLLER

1. Addition, subtraction, multiplication and division
2. Fibonacci series
3. Factorial of a number
4. Square root of a number
5. Gray code to 8 bit binary number conversion
6. Ascending and descending order
7. Conversion : Decimal to Octal and Decimal to hexadecimal

Course Outcome:

Successful completion of this course ,student will be able to

1. Students will acquire hands-on knowledge of programming practices in C++.
2. Students will learnsome of the mathematical and physics problems of numerical integration and differentiation, numerical solution
3. Work independently and function as a team.
4. Develop communication skills (oral, microprocessor and micro controller program and written).
5. Apply a methodology for materials selection to scientific problems for locate or estimate materials data and information relevant to a successful design analysis.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1.https://www.programiz.com/c-programming
2 https://www.geeksforgeeks.org/c-language-set-1-introduction/
3 https://beginnersbook.com/2014/01/c-tutorial-for-beginners-with-examples/

Mapping with programme outcomes 18PPH10P							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	9	3	9	6	9
CO2	9	9	6	9	9	9	9
CO3	9	9	9	9	6	3	6
CO4	9	9	9	6	9	9	9
CO5	9	9	3	9	3	9	3
Total	45	45	36	36	36	36	36
Weightage	**5.56**	**5.56**	**5.11**	**5.26**	**5.48**	**5.13**	**5.63**

***S-Strong(9); M-Medium(6); L-Low(3).**

CC11: NONLINEAR DYNAMICS AND RELATIVITY

SUB.CODE: 18PPH11

Course objectives:

The main objectives of this course are

1.To understand the integrable and nonintegrable physical systems interesting behaviours in addition to the theory of relativity.
2..To understand nonlinear phenomina occur in autonomous and non autonomous systems.
3. Students will be able to make Bifurcation diagram of logistic map and henon map.
4. Indroduction to nonlinear dynamics and chaos,recent application of chaos,computer and chaos,dynamical view of the world.
5. Basics of nonlinear sciences;Dynamics,types of dynamical systems and Nonlinearity.

UNIT – I: Non linear system and Bifurcation

Linear and nonlinear systems, autonomous and non autonomous systems- Linear super position principle – Equilibrium points – Classification for two dimensional case – Limit cycle motion – Periodic attractor – Poincare Bendixson theorem – Bifurcations - Saddle node, Pitchfork, Transcritical and Hopf Bifurcations.

UNIT – II: Chaos in Discrete and Continuous Dynamical Systems

Logistic map – Equilibrium points and their stability – Period doubling phenomenon – Onset of chaos – Lyapunov exponent – Bifurcation diagram of logistic map - Henon map – Period doubling – Self similar structure – Duffing Oscillator – Bifurcation Scenario – Period doubling route to chaos – Intermittency transition – Quasi periodic route to chaos.

UNIT – III: Choas in Non linear Electronic circuits and Hamiltonian chaos

.Linear and Non linear circuit elements – Non linear circuits – Chua's diode – Bifurcations and chaos – MLC circuit – Experimental Realization – Stability analysis – Experimental and Numerical studies.

Henon – Heiles system – Equilibrium points – Poincare surface of section – Periodically driven undamped Duffing Oscillator – Standard map – Linear stability and invariant curves – Numerical analysis – Regular and Chaotic motions – Kolmogorov – Arnold -Moser theorem.

UNIT – IV: Waves and solitons

Linear waves – Linear non dispersive wave propagation – Linear dispersive wave propagation – Fourier transform and solution of initial value problem- Wave packet and dispersion – Cnoidal and Solitary waves – Solitons – KDV equation – Fermi Pasta Ulam Paradox – Hirota bilinearization method – Lax pair – Inverse Scattering transform method for KdV equation.

UNIT – V: Relativity

Basic Postulates of Relativity – Lorentz transformations – Velocity addition and Thomas precession – Vectors and the metric tensor- Relativistic Kinematics of collisions and many particle systems – Relativistic angular momentum – Lagrangian formulation of relativistic mechanics – Relativistic One dimensional Harmonic oscillator – Introduction to General theory of relativity.

Course outcomes:

Successful completion of this course ,student will be able to

1. The students is expected to acquire basic knowledge of non linear differential equation.
2. The students is capable of finding Linear stability and invariant curves.
3. The students is can analyze Inverse Scattering transform method for KdV equation.
4. Understanding the basic of non linearity in physical systems.
5. Can acquire the knowledge that of relativity.

Books for Study

1. M. Lakshmanan and S. Rajasekar, Non Linear Dynamics , Springer Verlag, (2003)(For unit I – IV)
2. H. Goldstein, C. Poole and John Safko, Classical Mechanics, 3rd Edition, (Pearson Education, New Delhi, 2004(For unit V).

Mapping with programme outcomes 18PPH11							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	9	6	6	9	6
CO2	9	9	9	9	9	9	9
CO3	9	9	6	9	6	6	3
CO4	9	9	9	6	9	9	9
CO5	9	9	9	9	3	9	3
Total	45	45	42	39	33	42	30
Weightage	**5.56**	**5.56**	**5.96**	**5.70**	**5.02**	**5.98**	**4.69**

***S-Strong(9); M-Medium(6); L-Low(3).**

CC12: CONDENSED MATTER PHYSICS

SUB.CODE: 18PPH12

Course objectives:

The main objectives of this course are

1.Enable the students to understand about the crystals structure interaction with X-ray.
2.Helps the students to understand the interaction with lattice vibrations.
3.To understand the thermal and electrical properties in the free electron model.
4.To study the basic concepts of thermal and electrical conductivity.
5.To study the superconductivity using BCS theory

UNIT – I Crystal Diffraction and Reciprocal Lattice

Bragg law – Diffraction experiments – Laue method – Rotating crystal method – Powder method – Reciprocal lattice vectors – Condition for diffraction – Brillouin zones – Reciprocal lattice to simple cubic, face centered cubic and body centered cubic lattice – Fourier analysis of the basis – Structure factor – atomic form factor – Temperature dependence on spectral lines.

UNIT – II Crystal Binding and Lattice Vibrations

Van der Waals - London interaction Madelung energy and Madelung constant – Evaluations – covalent metal and hydrogen bonded crystals.

Vibrations of Monatomic lattices – Lattice with two atoms per primitive cell – Quantization of lattice vibration – Phonon momentum.

UNIT – III Energy Momentum and Semiconductor Crystals

Nearly free electron model – Bloch functions – Kronig penny model – Wave equation electron in a periodic potential – number of orbitals in band – Metals and insulators and semiconductors – Band gap – Equation of conductors – Effective mass of holes – Intrinsic carrier concentration – Thermoelectric effect in semi conductors – Electronic and lattice specific heat – Schottcky Barrier – Gunn – Effect Oscillators.

UNIT – IV Fermi Surfaces and Metals

Construction of Fermi surface – Electron orbits, hole orbits – Calculations of Energy bands – Tight binding method for energy bonds – Wigner Seitz method – Pseudo potential – Experimental methods – Quantization of orbits is a Magnetic field – De Haas – van Alpen effect – Electrical conductivity and ohms law – Motion of electrons in magnetic fields – Hall effect – Thermal conductivity of metals – Drude model of electrical and thermal conductivity.

UNIT – V Super Conductivity

Occurrence – Meissner effect – Heat capacity Thermodynamics of super conducting transition – London equation –Coherence length and London penetration depth – BCS theory of super conductivity – Flux quantization in a superconducting ring – type-I and type-II super conductors – Josephson super conductor tunneling – AC and DC Josephson effects -.
Super fluidity: Defects and dislocations – Ordered phase of matter, translational and orientation order – Kinds of liquid cryatalline order – Quasi crystals.

Course outcomes:

Successful completion of this course ,student will be able to

1. Understand the physics behind structural properties of the solids.
2. Understand and explain concentration of lattice in solids through different theories.
3. Tailor the properties of solids with proper understanding.
4. Able to elaborate thermal and electrical conductivity of metals, conductors and semiconductors.
5. .Able to . understand super conductors, types with their properties and applications.

Books for Study and Reference

1. C.Kittel, Introduction to Solid State Physics
2. S.O. Pillai, Solid State Physics.
3. www.physics.iisc.ernet.in ~ aveek_bid (Drude model)
4. Introduction to super fluidity – https://arxiv.org>pdf (Super fluidity)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1..https://nptel.ac.in/courses/113/104/113104014/
2..https://www.udemy.com/course/physics-intro-to-electricity-magnetism/
3. https://nptel.ac.in/courses/115/104/115104088/

Mapping with programme outcomes 18PPH12							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	6	6	3	9	6
CO2	9	9	9	9	9	9	9
CO3	9	9	9	6	3	6	3
CO4	9	9	9	9	9	9	9
CO5	9	9	3	9	6	3	6
Total	45	45	36	39	30	36	33
Weightage	**5.56**	**5.56**	**5.11**	**5.70**	**4.57**	**5.13**	**5.16**

***S-Strong(9); M-Medium(6); L-Low(3).**

CC13 : NUCLEAR AND PARTICLE PHYSICS

SUB.CODE: 18PPH13

Course objectives:
The main objectives of this course are

1. To understand the classification of subatomic particles and their properties along with their influences.
2. To learn about the decay phenomenon and the process how the will occur.
3. Knowledge of various models compare to nucleus.
4. Nuclear models: Liquid drop and shell models.
5. To find out properties of strong and weak interactions.

UNIT I BASIC NUCLEAR PROPERTIES

Nuclear size, shape, mass-charge distribution – spin and parity –Binding energy- semi empirical mass formula – nuclear stability- mass parabola –Nuclear forces: nature of nuclear force – ground state of deuteron – magnetic dipole moment of deuteron – proton – neutron scattering at low energies- scattering length, phase shift – proton –proton scattering at low energies – properties of nuclear forces- spin dependent – charge symmetry- charge independence- repulsion at short distances – exchange forces – meson theory.

UNIT II RADIOACTIVE DECAYS

Alpha emission- Geiger Nuttal law – Gamow theory – Neutrino hypothesis- Fermi theory of β decay – selection rules- Non conservation of parity- Gamma emission – selection rules- transition probability – internal conversion- nuclear isomerism- detection of nuclear radiations-interaction of charged particle with matter – basic principles of particle detectors – ionization chamber – proportional counter- G.M. counter – solid state detectors – scintillation and semiconductor detectors

UNIT III NUCLEAR REACTIONS

Conservation laws for nuclear reactions- reaction energetics- Q-value –relativistic and non – relativistic Q value – nuclear cross section- charged particle induced nuclear reaction – neutron induced nuclear reaction – reciprocity theorem – Breit Weigner formula –resonance theory – optical model theory of nuclear reactions.

UNIT IV ACCELERATORS AND REACTORS

Cyclotron – synchrocyclotron- Betatron- synchrotron- linear accelerators – nuclear fission and fusion: Characteristics of fission mass distribution of fragments- radioactive decay process- fission cross section – Energy in fission – Bohr- Wheeler's theory of nuclear fission – fission reactors – thermal reactors- homogeneous reactors – heterogeneous reactors – basic fusion process- characteristics of fusion- Solar fusion – controlled fusion – reactors – cold fusion.

UNIT V ELEMENTARY PARTICLES

Classification of fundamental forces and elementary particles-basic conservation laws- additional conversation laws: Baryonic, Leptonic, Strangeness and iso- spin charges/ quantum numbers – Gell- Mann- Nishijima formula – multiples- invariance under time reversal(T) , charge conjugate (C) and parity (P) – TCP theorem – parity non- conservation in weak interaction – CP violation – Eight fold and super multiples SU(3) symmetry and quark model

Course outcomes:
Successful completion of this course ,student will be able to

1. Significance of various decays tells the students about the nuclear process.
2. About the scattering process how it will occur.
3. It will about the spin parity concepts.
4. Use the liquid drop model and the law of radioactive decay to describe alpha- decay.
5. Determine nuclear properties such as binding energy, spin and parity in the frame work of the liquid drop model of the nucleus

Books for Study and Reference

1. S.B.Patel, Nuclear Physics, John Wiley(New Age International),.
2. B.L.Cohen , Concepts of Nuclear Physics, Tata McGraw Hill, New Delhi, 1988.
3. S.B.Patel, Nuclear Physics, John Wiley(New Age International),.
4. B.L.Cohen , Concepts of Nuclear Physics, Tata McGraw Hill, New Delhi, 1988.
5. H.S.Hans, Nuclear Physics: Experimental and Theoretical, New Age international Publishers, NewDelhi, 2001.
6. D.Griffths, Introduction to Elementary Particle Physics, Wiley International Edition, New York, 1987.
7. M.L.Pandya and R.P.S.Yadav, KedarNath Ram Nath Publishers, Meerut, 1989

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

https://nptel.ac.in/courses/115/104/115104043/
https://nptel.ac.in/courses/115/106/115106087/
https://nptel.ac.in/courses/115/103/115103101/ \

Mapping with programme outcomes 18PPH13							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	9	6	3	9	6
CO2	9	9	6	9	9	9	9
CO3	9	9	9	9	6	6	3
CO4	9	9	9	3	9	9	9
CO5	9	9	6	9	9	9	6
Total	45	45	39	36	36	42	33
Weightage	**5.56**	**5.56**	**5.53**	**5.26**	**5.48**	**5.98**	**5.16**

***S-Strong(9); M-Medium(6); L-Low(3).**

CC18 : PROJECT WORK

SUB.CODE: 18PPHN

Course Objectives:
The main objectives of this course are

1.To develop abilities and skills that encourage research and development activities and are useful in everyday life and understanding and competencies required by practicing teachers for effective teaching-learning process at the secondary stage.

2.sustained in depth study on a specific topic to enable the students to critically examine the background literature relevant to their the background literature relevant to their specific research area.

3.an environment that encourages the students originally and creativity in their research and opportunity to develop skills in making and testing hypotheses in developing new theories and in planning and conducting experiments,developing practical research skills and learn new stage of the art techniques.

4.the opportunity to expand the student's knowledge of their research area,including its theoretical foundation and the specific techniques used to study it.

.5. an environment in which to develop skills in written work,oral presentation and publishing the results of their research in scientific journals for future development and the students in acquiring basic knowledge in the specialized thrust areas such as condensed matter physics and nanoscience,theoretical physics,Crystal growth,Thin films in various fields of branch of physics.

PROJECT DISSERTATION

Course Outcomes:

Successful completion of this course

1.have some research experience with in a specific field of physics,through a supervised project (Master dissertation)

2.have a through knowledge of literature and a understanding of scientific methods and techniques applicable in their field of research.

3. be able to summarize major themes and current research problems in their area of specialization and be able to explain and identify open problems and areas needing development in their fields.

4.be able to demonstrate originality in the application of knowledge, together with a practical understanding of how research and enquiry are a used to create and interpret knowledge in their field.

5.be able to act independently in the planning and implementation of research and have carried out and presented an original work of research in their discipline.

Mapping with programme outcomes 18PPHN4							
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	9	9	9	6	9	9	9
CO2	9	9	6	9	9	9	6
CO3	9	9	9	9	9	3	9
CO4	9	9	9	9	3	9	3
CO5	9	9	6	9	9	6	3
Total	45	45	39	42	39	36	30
Weightage	**5.56**	**5.56**	**5.53**	**6.14**	**5.94**	**5.13**	**4.69**

***S-Strong(9); M-Medium(6); L-Low(3).**