Sadakathullah Appa College

(Autonomous)

(Reaccredited by NAAC at an 'A' Grade. An ISO 9001:2015 Certified Institution)

Rahmath Nagar, Tirunelveli - 11.
Tamil Nadu.

PG AND RESEARCH DEPARTMENT OF PHYSICS

CBCS SYLLABUS

For

M.Sc. PHYSICS

(Applicable for students admitted in June 2018 and onwards)

(As per the Resolutions of the Academic Council Meetings held on 03-03-2018 and 17-10-2018)

SADAKATHULLAH APPA COLLEGE (AUTONOMOUS)

(REACCREDITED BY NAAC WITH 'A' GRADE AND ISO 9001:2015 CERTIFIED INSTITUTION)
RAHMATH NAGAR, TIRUNELVELI – 627 011.
DEPARTMENT OF PHYSICS
SYLLABUS (CBCS)
M.Sc. (PHYSICS)

For those who join the course from 2018 – June onwards.

1.0 Objectives of the Course

The objective of the course is to create awareness in the field of physics and cultivate scientific approach and research aptitude among the graduate students in various subjects of physics and emerging extensions of research activities. The task includes preparation, enhancement etc. of human resources in strengthening the activities for the development of basic scientific knowledge, skills and application of scientific approach. An independent project is included in the course so that the candidate knows about the flavor of research methodology in science.

2.0 Eligibility for Admission

A candidate who has passed B.Sc. Degree Examination with Physics or Applied Physics is eligible for this course. However, candidates with any other undergraduate degree course in science such as Electronics, Nanoscience, etc. may also considered if the course is equivalent in terms of the syllabus by at least 80 % with regard to the core subjects of the under-graduate course in Physics of this college.

Knowledge

The candidate

- has substantial knowledge in physics, basic knowledge in mathematics, and knowledge in supported fields like computer science.
- has some research experience within a specific field of physics, through a supervised project.
- has advanced knowledge in some areas in physics.
- is familiar with contemporary research within various fields of physics.

Skills

The candidate

- has the background and experience required to model, analyse, and solve advanced problems in physics.
- is able to apply advanced theoretical and/or experimental methods, including the use of numerical methods and simulations.
- can combine and use knowledge from several disciplines.
- can critically and independently assess and evaluate research methods and results.
- has the ability to develop and renew scientific competence -- independently, via courses or through PhD studies in physics or related disciplines.

General competence

The candidate

- understands the role of physics in society and has the background to consider ethical problems.
- knows the historical development of physics, its possibilities and limitations, and understands the value of lifelong learning.
- is able to gather, assess, and make use of new information.
- has the ability to successfully carry out advanced tasks and projects, both independently and in collaboration with others, and also across disciplines.

CONTENTS

COURSE STRUCTURE

POST GRADUATE AND RESEARCH DEPARTMENT OF PHYSICS

CBCS Syllabus – M.Sc., Physics (2018-19 onwards)

SEM	P	Title of the paper	S. Code	H/W	C	Marks		
						I	E	T
I	DSC1	Mathematical Physics – I	18PCPH11	6	4	25	75	100
	DSC2	Classical Mechanics	18PCPH12	6	4	25	75	100
	DSC3	Molecular and Resonance spectroscopy	18PCPH13	6	4	25	75	100
	DSE-1	A) Integrated Electronics	18PEPH1A	4	4	25	75	100
		B) Nanoscience	18PEPH1B					
	P-I	Practical I General Physics Experiments – I	18PCPH1P1	4	2	40	60	100/2
	P-II	Practical II Advanced Electronics Experiments -I	18PCPH1P2	4	2	40	60	100/2
II	DSC4	Mathematical Physics – II	18PCPH21	5	4	25	75	100
	DSC5	Quantum Mechanics-I	18PCPH22	5	4	25	75	100
	DSC6	Statistical Mechanics	18PCPH23	5	4	25	75	100
	DSE-2	A) Microprocessor & Microcontroller	18PEPH2A	4	4	25	75	100
		B) Numerical Methods	18PEPH2B					
	P-III	Practical III General Physics Experiments – II	18PCPH2P1	4	2	40	60	100/2
	P – IV	Practical - IV Advanced Electronics Experiments -II	18PCPH2P2	4	2	40	60	100/2
	IDC-1	Renewable Energy	18PIPH21	3	3	25	75	100
III	DSC7	Quantum Mechanics-II	18PCPH31	5	4	25	75	100
	DSC8	Electromagnetic theory	18PCPH32	5	4	25	75	100
	DSC9	Nuclear and Particle Physics	18PCPH33	5	4	25	75	100
	DSE-3	A) Nonlinear Dynamics	18PEPH3A	4	4	25	75	100
		B) Crystal growth & Thin flims	18PEPH3B					
	P-V	Practical V Advanced Physics Experiments – I	18PCPH3P1	4	2	40	60	100/2
	P-VI	Practical VI Microprocessor Experiments	18PCPH3P2	4	2	40	60	100/2
	IDC-2	Digital Electronics	18PIPH31	3	3	25	75	100
IV	DSC10	Solid State Physics	18PCPH41	5	4	25	75	100
	DSC11	Research Methodology	18PCPH42	5	4	25	75	100
	DSC12	Project (P)	18PCPH43	8	8			100
	DSE4	A) Optoelectronics & Lasers	18PEPH4A	4	4	25	75	100
		B) Materials Science	18PEPH4B					
	P – VII	Practical-VII Advanced Physics Experiments - II	18PCPH4P1	4	2	40	60	100/2
	P- VIII	Practical-VIII Numerical methods and C++ Programming	18PCPH4P2	4	2	40	60	100/2
			Total	**120**	**90**			**2200**

e:

Dsc - Discipline Specific core 2

DSE - Discipline specific Elective

IDC - Inter Departmental Course

unit III -6%

I SEMESTER		
DSC1	MATHEMATICAL PHYSICS – I	18PCPH11
Hrs/Week : 6	Hrs/Sem : 90	Credits : 4

Preamble : Mathematical physics provides firm foundation in various mathematical methods developed and used for understanding different physical phenomena. This course provides mathematical tools to address formalisms used in the core course of masters level physics program.

Prerequisites : Undergraduate physics courses and faculty consent.

Objectives :

- To develop knowledge in mathematical physics and its applications.
- To develop expertise in mathematical techniques those are required in physics.
- To enhance problem solving skills.
- To give the ability to interpret and draw inferences from mathematical solutions.

UNIT – I: LINEAR VECTOR SPACE & MATRICES (20 hours)

Vector operations in curvelinear co-ordinates (rectangular, spherical, polar and cylindrical Polar co-ordinates) – Linear independence of vector – Dimensions – Basis – Inner product – Schmidt orthogonalization Process – Matrix representation of vectors – Similarity transformation of matrix – Eigen value and Eigenvectors of matrix.

UNIT II: POLYNOMIALS (18 hours)

Legendre differential equation and Legendre polynomial – Generating function – Rodrigue's formula – Orthogonal property – Recurrence formula – Hermite differential equation and Hermite polynomial – Orthogonal property – Recurrence formula – Rodrigue's formula.

UNIT III: LAPLACE AND FOURIER TRANSFORMS (18 hours)

Laplace transforms –solution and linear differential equations with constants coefficients- Fourier integral- Fourier sine and cosine transform- Inverse Fourier transform - Convolution theorems.

UNIT IV: ABSTRACT GROUP THEORY (16 hours)

Group postulates– Abelian group – Cyclic group –The group multiplication table –Subgroups – Cosets – Conjugate elements and classes -Isomorphism and Homomorphism –Cayley's theorem - Group symmetry of a equilateral triangle - Group symmetry of a equilateral square

UNIT V: REPRESENTATION OF GROUPS (18 hours)

Reducible and irreducible representations – Some important theorems on representation (Theorem1, 2 & 3) - Orthogonality Theorem –The character of a representation: character tables – C_{2v} & C_{3v}.

BOOKS FOR STUDY

1. Murray R. Spiegel, Seymour Lipschutz and Dennis Spellman, Vector Analysis Schaum's outline series, Tata McGraw-Hill, Second Edition (2009)
2. Frank Ayers -Matrices — Schaum's Series – TMH edition McGraw-Hill, New Delhi (1984)
3. George B. Arfken and Hans J. Weber - Mathematical Methods for Physicists, cademic Press, Sixth Edition (2005)
4. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Willey Publications, 1962.

BOOKS FOR REFERENCE

1. Michael Tinkham - Group theory and Quantum Mechanics –TMH edition new Delhi (1974).
2. A W. Joshi - Matrices and Tensors in Physics – Third edition – New Age International (P Ltd. (1995).
3. Satya Prakash–Mathematical Physics–Sulthan Chand & Sons–New Delhi (2005).

unit V - 20%

I SEMESTER		
DSC2	CLASSICAL MECHANICS	18PCPH12
Hrs/Week : 6	Hrs/Sem : 90	Credits : 4

Preample: Classical mechanics is one of the backbone of physics which deals with understanding the motion of particles. The present course covers topics beyond the Newtonian.

Prerequisite: Basics of physics.

Objectives:

- To allow the student to have a deep knowledge of the fundamentals of classical mechanics.
- To introduce general methods of studying the dynamics of particle systems.
- To give experience in using mathematical techniques for solving practical problems.
- To lay the foundations for further studies in physics and engineering.

UNIT I FUNDAMENTAL PRINCIPLES AND LAGRANGIAN FORMULATION (20 hours)

Mechanics of a particle and system of particles – Conservation laws - Constraints – Generalised co-ordinates - D' Alembert's principle – Lagrange's equations –Velocity dependent potentials and the dissipation function - Simple applications of Lagrange's formulation – Hamilton's principle – Lagrange's equation from D' Alembert's principle.

UNIT – II TWO BODY CENTRAL FORCE PROBLEM (18 hours)

Reduction to the equivalent one body problem – Equations of motion and first integrals – Virial theorem – Differential equation for the orbit - Kepler problem: Inverse square law of force – Scattering in a central force field – Transformation of scattering problems to laboratory coordinates.

UNIT – III DYNAMICS OF RIGID BODY (18 hours)

Rigid body motion – Independent coordinates of a rigid body – Euler angles – Angular momentum of rigid body – Moments and products of inertia – Rotational kinetic energy –Equation of motion for a rigid body - Euler's equations – Torque free motion – Poinsot solutions – Coriolis force.

UNIT IV HAMILTONIAN FORMULATION OF MECHANICS (18 hours)

Hamilton's equation from variational principle - Principle of least action - Canonical transformation – Generating Functions – Poisson's brackets – Equations of motion in Poisson bracket form – Hamilton's Jacobi equation for Hamilton's principal function – Harmonic Oscillator problem – Hamilton's characteristic Function – Separation of variables – Action angle variables.

UNIT V MECHANICS OF SMALL OSCILLATIONS (16 hours)

Stable and unstable Equilibrium - Formulation of the problem - Lagrange's equation of motion for small oscillations - Properties of T,V and ω - Normal Co-ordinates and normal frequencies of vibration - Free vibrations of linear tri atomic molecule.

BOOKS FOR STUDY

1. H.Goldstein - Classical Mechanics - Addition Wesley, III Edition, 2000.
2. John R. Taylor - Classical Mechanics, Edwards Brothers, Inc, 2005
3. R. G. Takwale and P. S. Puranik – Introduction to Classical Mechanics - Tata McGraw - Hill Publishing Company Ltd. (1989).

BOOKS FOR REFERENCE

1. V.B. Bhatia - Classical Mechanics – Narosa Publishing house, New Delhi, 1997.
2. B. D. Gupta, Satya Prakash and Kedarnath Ramnath - Classical Mechanics – New Delhi (2012).
3. N.C. Rana and P.S. Joag - Classical Mechanics - Tata McGraw-Hill, I Edition, 1991.
4. Daniel Kleppner & Robert Kolenkow, An Introduction to Mechanics, Tata McgrawHill Education.

unit II-20%
unit IV - 8%

I SEMESTER		
DSC3	MOLECULAR AND RESONANCE SPECTROSCOPY	18PCPH13
Hrs/Week : 6	Hrs/Sem : 90	Credits : 4

Preample: This module aims at teaching Theory of Spectroscopic Methods in a way that the student will find easy to follow. It endeavours to introduce the theoretical basics behind the various spectroscopic methods available to a chemist for the elucidation of molecular structures.It aims at introducing, in a less mathematically rigorous way, how electromagnetic radiationinteracts with molecules to produce spectra that give useful information about molecular structures.

Prerequisites : Undergraduate physics courses and faculty consent

Objectives:

- To understand the general concepts in Microwave Spectroscopy.
- To explore the field of Vibrational Spectroscopy.
- To understand the principles in Nuclear Magnetic Resonance Spectroscopy.
- To emphasize the significance of Nonlinear Raman Spectroscopy.

UNIT I: MICROWAVE SPECTROSCOPY (18 hours)

Classification of molecules – Rotational spectra of rigid diatomic molecules – Isotope effect in rotational spectra- Intensity of rotational lines – Non-Rigid rotator- Linear polyatomic molecules – Symmetric top molecules- Asymmetric top molecules – Microwave spectrometer – Information derived from rotational spectra.

UNIT II: NORMAL COORDINATE ANALYSIS (18 hours)

Selection rules for Raman and IR vibrational normal modes – Normal for Raman and IR activity C2V and C3V point groups – Representation of Molecular Vibrations in Symmetry co-ordinates – Normal coordinate analysis for H2O molecule.

UNIT III: INFRARED and ELECTRONIC SPECTROSCOPY(20 hours)

Vibrational energy of a diatomic molecule – Infrared selection rules- Vibrating diatomic molecule – Diatomic rotator – Vibrational coarse structure- Vibrational analysis of Band systems – Progressions and Sequences - Frank–Condon principle – Rotational fine structure of Electronic vibration spectra – IR spectrometer – Instrumentation.

UNIT IV: RAMAN SPECTROSCOPY (16 hours)

Theory of Raman scattering – Rotational Raman spectra – Linear and symmetric top molecules - Vibrational Raman spectra- Raman spectrometer – Structure determination using IR and Raman spectroscopy – Nonlinear Raman scattering – Hyper Raman effect –classical treatment of hyper Raman scattering-Stimulated Raman.

UNIT V: RESONANCE SPECTROSCOPY (18 hours)

NMR – Magnetic properties of nuclei – Resonance condition – NMR Instrumentation - ESR – Principle – ESR spectrometer –NQR – The quadrupole nucleus - Principle –NQR Instrumentation- Mossbauer spectroscopy –principle- Instrumentation

BOOKS FOR STUDY:

1. Colin N. Banwell and ; Elaine M.McCash - Fundamentals of molecular spectroscopy - IV
Edition TMG Hill Publishing Comp, New Delhi, (1998).
2 G. Aruldhas, Molecular structure and Spectroscopy, II edition, Prentice Hall of India ,
Pvt Ltd, New Delhi (2000).
3. D. N. Satyanarayana, Vibrational Spectroscopy and Applications, New Age International
Publication, New Delhi,(2004).

BOOKS FOR REFERENCE:

1. GR Chatwal and S.K. Anand –Spectroscopy- Edition II , HP house ,New Delhi (1995)
2. Suresh Chandra - Molecular spectroscopy, Narosa Publishing House Chennai (2009)
3. D. D. Jyaji and M. D Yadav , Spectroscopy, Amol Publications, New Delhi, (1991).

unit II - 20%

I SEMESTER		
DSE – 1A	INTEGRATED ELECTRONICS	18PEPH1A
Hrs/Week : 4	Hrs/Sem : 60	Credits : 4

Preample: This course is devoted to fundamental theory and recent developments addressing the related theoretical and practical aspects on electronic devices, their characteristics and applications. Major Course Contents transoitors, op-amp, semiconductor memories and special diodes.

Prerequisite: Basics of physics.

Objectives:

- To give clear understanding of various fabrication techniques of electronic devices.
- To understand the physical construction, working, operational characteristics, and applications of Semiconductor devices.
- To introduce the basic ideas and importance of some advanced electronic devices.

UNIT I: TRANSISTORS(10 hours)

Bipolar Junction Transistor (BJT), Junction Field Effect Transistor (JFET), Metal oxide Semiconductor Field Effect Transistor (MOSFET) and Metal Semiconductor Field Effect Transistor (MESFET) – Structure, Working, fabrications, I-V characteristics - Applications- Advantages and disadvantages.

UNIT II: OPERATIONAL AMPLIFIER (12 hours)

Introduction to Operational Amplifiers- Pin diagram- Characteristics- CMRR- Slew rate- Open and Closed loop. Applications (Inverting&Non-inverting adders, subtractor, integrator and differentiator).

UNIT III: SEMICONDUCTOR MEMORIES (12 hours)

Static and Dynamic random access memories (SRAM and DRAM)– Difference between SRAM&DRAM. Classifications : PROM-EPROM-EEPROM-EAPROM-RAM-ROM. CMOS&NMOS(Construction, working and applications) Magnetic memorie –Charge Coupled Devices (CCD).

UNIT IV: ADVANCED ELECTRONIC DEVICES (13 hours)

Photo electronic devices: solar cell- photo detector – LED (Principle, working, construction, applications). Sensors- Transducers-Piezoelectric devices.

UNIT V: SPECIAL DIODES (13 hours)

Tunnel diode – Gunn diode (Transfer electron device) — Laser diode-Parametric devices: V-I Characteristics- Applications-Advantage & disadvantages.

BOOKS FOR STUDY

1. Salivahanan - Electronic devices and circuits, Tata McGraw Hill Publications, New Delhi (1998) (Unit 1,2,3&5)
2. John Wilson, J.F.B.Hawkes - Opto electronics: An introduction- Prentice Hall Publications, Third Edition, New Delhi (Unit 4) (2011)

BOOKS FOR REFERENCE

1. SM.Sze - Semiconductor devices – Physics and technology,Wiley, New York (1985).
2. Ajay Ghatak and Thyagarajan - Opto electronics - Cambridge University Press, New Delhi
(1989).

New paper - 100%

I SEMESTER		
DSE – 1B	NANO SCIENCE	18PEPH1B
Hrs/Week : 4	Hrs/Sem : 60	Credits : 4

Preamble: The objective of this course is to introduce the emerging nanotechnology field to novices of nanotechnology including, but not limited to, students. In present days nanotechnology is being used successively in almost all fields

Prerequisite: Basic properties of nano physics.

Objectives:

- To focus on nanoscience and technology.
- To promote knowledge on applications of nanomaterials with physics emphasis.
- To enrich research aptitude on nanotechnology.

Unit 1: Nanomaterials (10 hours)

Nanostructures: Nanomaterials in one, two and three dimensions- Synthesis of oxide nanoparticle (sol-gel&processing), metallic nanoparticles (electrochemical deposition method), semiconductor nanoparticles (arrested precipitation method) - properties of nanomaterials.

Unit II: Carbon Nanotubes (12 hours)

Carbon Nanotubes: Types of carbon nanotubes –synthesis of carbon nanotubes: Electric arc discharge method – Laser method - solar production of CNT – purification methods – properties – Application of carbon nanotubes.

Unit III: Quantum Heterostructures(12 hours)

Quantum heterostructures: Introduction – heterostructure – growth of heterostructures: molecular beam epitaxy – Metal organic chemical vapour deposition – Heterojunction band alignment – Quantum well- Doped heterostructures : Modulation doping – Quantum wells in heterostructures.

Unit IV: Quantum dots and Quantum wires: (12 hours)

Quantum wire –Production of nanowires: The VLS growth mechanism – structure of nanowires – use of nanowires – Quantum dot – Fabrication feehniques – properties of dots – Application of quantum dots

Unit V: Magnetoelectronics and applications of nanoscience(14 hours)

Magnetism in nanocrystals-Coulomb blockade – Single electron transistor– spintronics – Giant magnetoresistance _ Quantum Hall effect –Fractional quantum Hall effect – Application of nanotechnology – medical applications of molecular nanotechnology.

BOOKS FOR STUDY

1. Guozhong Cao – Nanostructures &Nanomaterials: Synthesis, Properties & Applications- Imperial College Press, London, 2004.
2. Introduction to nanotechnology by Charles P.Poole, Frank J. Owens, John Wiley & Sons publication, New York(2003).
3. G.Schmidt - Nanoparticles: from theory to application, Wiley Weinheim, New York (2004).

BOOKS FOR REFERENCES:

1. C.Rechard Brundle, Charles A.Evans -Encyclopedia of materials characterization-Butterworth- Heinemann publishers, New York (1992).
2. T.Pradeep- Nano: The Essentials – Understanding Nanoscience and Nanotechnology – McGraw-Hill, 2008.

Experiment 8,9,10,12 added - 25%

I SEMESTER		
P- I	GENERAL PHYSICS EXPERIMENTS - I	18PCPH1P1
Hrs/Week : 4	Hrs/Sem : 60	Credits : 2

Course Objectives: The aim and objective of the courses on **General Physics Lab** is to train the students of M.Sc. class to advanced experimental techniques in physics so that they can investigate various relevant aspects and are confident to handle sophisticated equipment and analyze the data.

(Any Eight)

1. Magnetic Susceptibility - Quinke's Method
2. Ultrasonic interferometer – velocity and compressibility of any two liquids
3. Cauchy's constants by least sequence fit (Experimental method)
4. Temperature coefficient of a thermistor
5. ESR Spectrometer – Determination of Lande's g-factor
6. Experiments based on He-Ne laser.
7. Force constant calculation from vibration spectrum
8. Anderson's Bridge - Determination of self inductance of the given coil - (different turns/coil).
9. Characteristics of photovoltaic cell.
10. Determination of Dielectric constants and loss of solids.
11. Determination of linear optical parameters using Uv – Visible spectral data.
12. Determination of self inductance-Maxwell's bridge.

Experiments 7,10,11,12 added - 25%

I SEMESTER		
P- II	ADVANCED ELECTRONICS EXPERIMENTS-I	18PCPH1P2
Hrs/Week : 4	Hrs/Sem : 60	Credits : 2

Course Objectives: The aim and objective of the laboratory on **Electronics Lab** is to expose the students of M.Sc. class to experimental techniques in electronics so that they can verify some of the things read in theory here or in earlier classes and develop confidence to handle sophisticated equipment.

(Any Eight)

1. D/A converters using IC 741
2. Characteristics of Opto electronic devices (LDR, Photodiode, LED, Photovoltaic cell)
3. Construction of square and triangular wave generator using op-amp.
4. Solution of simultaneous equations using op-amp
5. Up, down counters using IC7476/7473
6. Arithmetic operations using IC 7483
7. Design/study of a Regulated Power Supply.
8. Op-amp characteristics – Inverting and Non inverting amplifiers
9. Schmitt Trigger- Using Transistors
10. Sine wave generator using Ic-741
11. Experiment using Op-Amp.
12. Transistor characteristics.

No change

II SEMESTER		
DSC4	MATHEMATICAL PHYSICS – II	18PCPH21
Hrs/Week : 5	Hrs/Sem : 75	Credits : 4

Preamble : Mathematical physics provides firm foundation in various mathematical methods developed and used for understanding different physical phenomena. This course provides mathematical tools to address formalisms used in the core course of masters level physics program.

Prerequisites : Undergraduate physics courses and faculty consent.

Objectives:

- To introduce advanced mathematical methods in physics and their applications.
- To enable students to use mathematical concepts required in physics.
- To develop expertise in solving the complex problems in physics.
- To prepare the students to formulate, interpret and draw inferences from complex physical concepts.

UNIT I: COMPLEX ANALYSIS (15 hours)

Functions of complex variable – Cauchy Riemann differential equation – Cauchy's integral theorem - Cauchy's integral formula – Taylor's series – Laurent's series – Cauchy residue theorem –Residues and their evaluations.

UNIT II: POLYNOMIALS (15 hours)

Bessel differential equation and Bessel's function – Recurrence relations – Orthonormality of Bessel's functions – Generating function – Laguerre's Differential equation and Laguerre polynomials – Generating function – Recurrence relations – Orthogonal property

UNIT III: PARTIAL DIFFERENTIAL EQUATIONS(16 hours)

Solution of heat flow equation (Method of separation of variables) – Variable linear flow in an infinite bar – two dimentional heat flow - three dimentional heat flow – Heat flow in circular and rectangular plates – Equation of motion for the vibrating string – Vibrations of a rectangular membrane - Vibrations of a circular membrane

UNIT IV: TENSORS (14 hours)

Occurrence of tensors in physics – Contravariant & Covariant tensors – Tensors of second rank – Algebra of tensors – Equality and null tensors – Addition and subtraction – outer product – Inner product – Contraction of tensors – Symmetric and Anti-symmetric tensor – Kronecker delta – Quotient law – Metric tensor-Simple applications of tensors to non-relativistic physics.

UNIT V: DIRAC DELTA FUNCTION AND GREEN'S FUNCTION (15 hours)

Dirac delta function – Some representation of dirac delta function – Properties of dirac delta function – Green's functions – Symmetric property – Greens functions for boundary value problems – Green's functions for Poisson's equation

BOOKS FOR STUDY

1. Pipes and Harvil - Applied Mathematics for Engineers and Physicists – McGraw Hill

International Book Company, New Delhi, (1984).

2. A. W. Joshi - Matrices and Tensors in Physics , 3rd edition – New Age International (P)

Ltd, New Delhi (1995) – UNIT IV (15.1, 15.3, 15.4, 15.5, 16.1 – 16.6, 17.1, 18.1)

3. George B. Arfken and Hans J. Weber, Mathematical Methods for Physicists, Academic Press, Sixth Edition (2005).

BOOKS FOR REFERENCES

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and sons (Asia), 8th Edition (2005).
2. Murray R. Spiegel – Theory and Problem of Complex variables –Schaum's series – McGraw-Hill, New Delhi (1988).
3. Satya Prakash–Mathematical Physics–Sulthan Chand & Sons–New Delhi (2005).

II SEMESTER		
DSC5	QUANTUM MECHANICS - I	18PCPH22
Hrs/Week : 5	Hrs/Sem : 75	Credit: 4

Preamble. Classical physics describes our everyday world very accurately and has done so for the past centuries. However, when we look very closely, that is, on the scale of molecules and atoms, things start to behave differently and we have to use a physical description that has become known as quantum theory. This course provides the fundamentals of quantum mechanics, angular momentum and identical particles.

Prerequisites : Undergraduate physics courses and faculty consent.

Objectives:

- To know about the fundamentals of quantum mechanics.
- To explain the basic principles of quantum mechanics.
- To develop the equation of motion of certain bound states
- To get some knowledge about angular momentum and identical particles and spin.

UNIT 1: FUNDAMENTALS OF QUANTUM MECHANICS (15 hours)

Postulates of quantum mechanics- Equation of motion of matter waves- Physical interpretation of wave function- Normalised and orthogonal wave functions-Solution of Schrödinger equation-Stationary state solution- Expectation values of dynamical quantities- Probability current density- Ehrensfest's theorem –Uncertainty principle-Mathematical proof of Uncertainty principle for one dimensional wave packet.

UNIT II : BOUND STATE AND POTENTIAL BARRIERS (20 hours)

Bound State Problems – Particle in a box – One dimensional square well potential – Finite potential step – Linear harmonic oscillator – Schrodinger equation-eigen values, energy eigen function- Rigid rotator- wave equation- eigen values and eigenfunction for the rotator- Hydrogen atom -solution of radial equation- energy levels.

UNIT III : EQUATION OF MOTION AND MATRIX MECHANICS (12 hours)

Equations of motion - Schrödinger picture - Heisenberg picture – Interaction picture -Poisson bracket and commutator bracket– Density operator-Density matrix for a single system- Matrix theory of Harmonic oscillator – Dirac's BRA and KET vectors-Linear vector space and Hilbert space- Projection and Displacement operators– Matrix representation for position, momentum, creation and annihilation operation.

UNIT IV: ANGULAR MOMENTA AND THEIR PROPERTIES (15 hours)

Introduction- Angular momentum operator in position representation- The rotational operator and angular momentum- The total angular momentum operators – commutation relation of total angular momentum with components- Raising and lowering operators in angular momentum - Eigen values of J^2 and J_z - Addition of angular momenta- Clebsch Gordan coefficients $j_1=1/2$, $j_2=1/2$

UNIT V: IDENTICAL PARTICLES & SPIN (13 hours)

Identical Particle– Symmetric and anti-symmetric wave functions- Particle exchange operator - Spin angular momentum- The Pauli's exclusion principle - Electronic spin hypothesis: Pauli's spin matrices for electron- Pauli's operators - Density operator and density matrix-Time dependent of density matrix

BOOKS FOR STUDY:

1. L.I. Schiff – Quantum Mechanics – Mc Graw Hill Book Company, New York, Third Edition., 2002.
2. P.M. Mathews and Venkatesan – A Text Book of Quantum Mechanics – Tata McGraw- Hill, New Delhi, (1976).
3. S. Rajasekar and R. Velusamy, Quantum Mechanics-Fundamentals-I & II, CRC Press, New York, 2005.

BOOKS FOR REFERENCE:

1. V. Devanathan – Quantum Mechanics – Narosa Publishing House Pvt. Ltd., 2005, Chennai.
2. G. Aruldhas – Quantum Mechanics – Prentice – Hall of India, New Delhi 2002.
3. Advanced Quantum Mechanics- Sathya prakash- Kedar Nath Ram Nath Publication, New Delhi, (2009).

unit I -2%
unit II-4%
unit III - 20%
unit IV -20%
unit V - 8%

II SEMESTER		
DSC 6	STATISTICAL MECHANICS	18PCPH23
Hrs/Week : 5	Hrs/Sem : 75	Credits : 4

Preamble : Statistical mechanics use methods of probability are used to extend the mechanics to many-body systems. It also acts as bridge between thermodynamics and mechanics of constituent particles. Statistical mechanics of ideal gas systems provide basic functioning of the formalisms of statical mechanics. This course provide the basic concepts and various classical and quantum statistics.

Prerequisites. : Undergraduate Physics Courses and First course Quantum mechanics and faculty consent.

Objectives:

- To understand the basics of Statistical systems.
- To understand the various laws of classical and quantum statistics.
- To acquire the knowledge of various statistical distributions.
- To comprehend the concepts of entropy, phase transitions and thermodynamic functions.

UNIT I: BASIC CONCEPTS (15 hours)

Phase space -Ensemble – Microcanonical, Canonical and Grand canonical ensemble-Density of distribution in the phase space- Postulates of equal a priori probability – Time and Ensemble averages – Microstates and macrostates - Counting the number of microstates in a phase space- Entropy of Ideal gas: Sackur-Tetrode equation – Gibb's Paradox- Liouville's Theorem.

UNIT II METHODS OF ENSEMBLES: PARTITION FUNCTIONS (20 hours)

Gibb's canonical ensemble-Thermo dynamical functions for the canonical ensemble and Partition function- Perfect monoatomic gas in canonical ensemble: Partition function, Helmholtz free energy, Entropy, Internal energy - System in contact with a particle reservoir- partition function and thermodynamic function for grand canonical ensemble- Perfect gas in grand canonical ensemble.

UNIT III QUANTUM STATISTICS (13 hours)

Postulatory foundations of quantum mechanics-Transition from classical statistical mechanics to quantum statistical mechanics-Indistinguishability and quantum statistics-Bose-Einstein Statistics-Fermi-Dirac statistics-Maxwell-Boltzmann statistics-Black body radiation and the Planck radiation law.

UNIT IV APPLICATIONS OF QUANTUM STATISTICS (15 hours)

Specific heat of solids-Dulong and Petit law-Einstein theory of specific heat of solids-Debye theory of specific heat of solids- Ideal Bose Einstein Gas –Energy and pressure of gas- Bose-Einstein Condensation -Ideal Fermi Dirac gas.

UNIT V PHASE TRANSITIONS (12 hours)

Phase transition: First order and second order phase transitions - Ising model-Braggs-Williams approximation- Phase transitions of second kind: One dimensional Ising model- Landau's theory of phase transitions.

BOOKS FOR STUDY:

1. Sathya prakash- Statistical Mechanics, Kedar nath ram nath Publications, Delhi,2015 (Unit 1, 2,3,4,5)
2. Dr.S.L.Gupta & Dr. V.Kumar, Statistical Mechanics , Pragati Prakasan Publications, Meerut,28th Edition, 2015 (Unit 3,4)
3. F.W. Sears and G. L. Salinger, Thermodynamics, Kinetic theory, and statistical Thermodynamics -Third Edition, NarosaPublishong House, 2011.
4. Kerson Huang, Statistical Mechanics – John Wiley & Sons, Inc., New York, 1987, Second edition.

BOOKS FOR REFERENCE :

1. A.K.Dasgupta – Fundamentals of Statistical Mechanics – New Central Book Agency (P) Ltd., Calcutta, 2000.
2. Sears and Zymanski – Statistical Mechanics – McGraw Hill Book Company, New York, 2011.
3. FederickReif. - Fundamentals of Statistical and thermal Physics – McGraw Hill International Editions, Singapore, 1985

No change

II SEMESTER		
DSE-2A	MICROPROCESSOR AND MICROCONTROLLERS	18PEPH2A
Hrs/Week : 4	Hrs/Sem : 60	Credits : 4

Preamble. Microprocessor and microcontroller have become important building blocks in digital electronics design. It is important for student to understand the architecture of a microprocessor and its interfacing with various modules. 8085 microprocessor architecture, programming, and interfacing is dealt in detail in this course. Interfacing, assembly language programming and interfacing of 8051 microcontroller and its application in industry are also covered in this course.

Prerequisites: Basic knowledge of computer and its operation

Objectives:

- To promote an idea about the architecture and working of microprocessors and micro controllers.
- To know the applications of microprocessor based systems.
- To enhance the programming skill among the students.
- To provide an exposure to the popular microprocessor Intel 8085 and microcontroller 8051.

UNIT I: 8 BIT MICROPROCESSORS(10 hours)

Introduction – Intel 8085 microprocessor (Pin configurations and their functions) – Architecture (ALU, Registers, Timing control unit, Bus system, Flag and interrupts-) opcode and operands - Instruction word size.

UNIT II: INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING (12 hours)

Addressing modes of 8085(Register addressing, Direct Addressing, register indirect addressing, Immediate addressing and Implicit addressing). Instruction sets of Intel 8085 (Data transfer, Arithmetic, logical, branch, stack, I/o and machine control group)- Simple assembly language programs (8 bit addition, subtraction, multiplation, division, largest and smallest numbers).

UNIT III: 8 BIT MICROCONTROLLERS(12 hours)

Introduction of 8051 microcontroller- Architecture –Addressing modes (Register, Direct, Register indirect, Immediate, and Base register plus index register indirect addressing). Instruction set of 8051 (Data transfer, Arithmetic, logical, program branching and Boolean variable).

UNIT IV: INTERFACING (14 hours)

Introduction- Interfacing scheme (Memory, I/O, memory &I/O mapped)- Data transfer scheme (Programmed & DMA)- Intel 8255 (Programmable Peripheral Interface and operating modes of 8255) -Intel 8279 (Keyboard and display interface) -D/A and A/D converters.

UNIT V: MICROPROCESSOR BASED SYSTEMS (12 hours)

Introduction- Microprocessor based system: Temperature control system, Motor speed control system and Traffic light control system.

BOOKS FOR STUDY:

1. Ramesh Gaonkar, Microprocessor Architechture, Programming and Applications with the 8085, Penram International Publishing (India) Private Limited, Fifthedition, 2012
2. Fundamentals of Microprocessors and microcontrollers – B. Ram, Dhanpat Rai publications ,2005, New Delhi.
3. Microprocessors and microcontrollers– A.Nagoor Kani, Tata McGraw-Hill Education Pvt. Ltd., 2nd Edition, 2012, New Delhi.

BOOKS FOR REFERENCE:

1. The 8051 microcontroller- Kenneth J Ayala, 3rd Edition, Cengage learning, 2010, New York.
2. Advanced Microprocessors and Peripherals – A.K. Ray and K M Bhurchandani, Tata McGraw-Hill Ltd., 2007, New Delhi.
3. Microprocessor Architecture, Programming and application with the 8085- Ramesh S.Gaonkar, Penram International Publishing (India) Pvt. Ltd, 4th Edition, New Delhi.

New paper-100%

II SEMESTER		
DSE-2B	NUMERICAL METHODS AND PROGRAMMING	18PEPH2B
Hrs/Week : 4	Hrs/Sem : 60	Credits :4

Preample: The goal of the course is to present essential statistical concepts.Simulation is used to illustrate the concepts and to provide understanding. Mathematical development provides an alternative presentation of the same ideas, when that is possible, and is used to develop a tool or get insight into a concept. Because the statistics/estimators/tests etc. can be complex, several numerical methods are introduced.E.g. Gradient descent, Newton's method, iteratively reweighted least squares, etc

Prerequisites: Basic knowledge of C++ programming and mathematics

Objectives:

- Understand and apply basics knowledge of numerical methods in solving the physics problems.
- Write programme with the C++ or any other high level language.
- Learn use of graphical methods in data analysis and solving physics problems.
- Solve physical problem, enabling development of critical thinking and analytical reasoning.
- Explore application of computational physics in frontier areas of pure and applied research in physics and allied fields.

Unit I Numerical Methods (12 hours)

Methods for determination of zeroes of linear and nonlinear algebraic equations and transcendental equations, convergence of solutions- Solutions of simultaneous linear equations- Gaussian elimination- pivoting- iterative Method

Unit II Interpolation, Curve fitting, Numerical differentiation and Integrations. (10 hours)

Finite differences- interpolation with equally spaced and unevenly spaced points-Curve fitting- Polynomial least squares- Numerical differentiation and integration, Newton-Cotes formulae- error estimates

Unit III Monte Carlo methods and numerical solution of differential equations : (14 hours)

Random variate-Monte Carlo evaluation of integrals, Methods of importance sampling, Random walk - Metropolis method-Numerical solutions of ordinary differential equations- Euler and Runge -Kutta methods.

Unit IV Numerical solution of partial differential equations (12 hours)

Finite – Differences Approximations to Derivatives – Laplace's equation – Jacobi's method – Gauss-Seidel method – SOR method – The ADI method – Parabolic equations – Iterative methods for the solution of equations.

Unit: V C++ Programming applications (12 hours)

Euler's Method: Charging and discharging of a condenser; Runge-Kutta methods: Radioactive Decay- Newton-Raphson method: Solution van der Waals equation; Linear fitting. - least square method : Cauchy's constant; Simpson's and Monte-Carlo methods : Evaluation of (integral) area under the curve; Eigenvalues and eigenvectors of symmetry matrices.

BOOKS FOR STUDY:

1. S.S. Sastry : Introductory Methods of Numerical Analysis, III rd Edition, Prentice Hall India Ltd, New Delhi , 2003
2. Numerical Methods in Science and Engineering-M.K.Venketaraman, National Publishing Co, 1989, New Delhi.
3. E. Balagurusamy, Object oriented Programming with C++, II Edition, Tata-McGraw Hill Publishing Company Ltd., New Delhi, 2001

BOOKS FOR REFERENCE:

1. P. Kandasamy, K. Thilagavathy, K.Gunavathi, Numerical Methods , S. Chand & Company Ltd., New Delhi, 2009.
2. The C programming language by Kernigham & Richie, PHI Publication New Delhi-2007, 2nd Edition.
3. V. Chinnathambi and U. Sankar, C++ for Physicists, Nanolight Publications, Palayamkottai, 2007.

Experiments 5,8,10,11 added-25%

II SEMESTER		
P-III	GENERAL PHYSICS EXPERIMENTS - II	18PCPH2P1
Hrs/Week : 4	Hrs/Sem : 60	Credits : 2

Course Learning Objective(s):

- To experimentally realize the structural, optical and electric behavior of condensed matters.
- Imparting knowledge about modulation of light, LEDs, Lasers, and Photodetectors important for fiber-optic communication.
- origin of magnetism in materials.

(Any Eight)

1. Hyperbolic fringes – Determination of elastic constants
2. Optical fibre – Determination of Numerical Aperture, acceptance angle, power loss and attenuation co efficient.
3. Particle size determination using He-Ne laser
4. Determination of the wavelength of the laser using grating and determination of the thickness of the wire.
5. Optical and Electrical characteristics of a given LED / B-H Curve.
6. Experiment using spectrometer
7. Mutual inductance – coupling co efficient as a function of distance and angle.
8. Determination of Nonlinear optical parameters of solids using Z scan techniques
9. Dielectric constant and loss of liquids.
10. Solar based Experiments.
11. Determination of mechanical properties of the solids using Vickers microhardness tester (given data).
12. Determination of electrical parameters of materials using impedance spectral analysis.

Experiment 8,9,10,12 added - 25%

II SEMESTER		
P-IV	ADVANCED ELECTRONICS EXPERIMENTS-II	18PCPH2P2
Hrs/Week : 4	Hrs/Sem : 60	Credits : 2

Course Objectives:

- To provide theoretical knowledge and develop practical skill in digital systems, logic systems electronic systems.
- Operating and designing digital systems.
- To solve problems in design and/ or implementation of digital

(Any Eight)

1. Active filters – Low pass, high pass and Band pass filters using IC 741
2. Counters 2 to 10/ MUX and DEMUX.
3. UJT characteristics / SCR Characteristics and power control.
4. BCD adder using IC 7483/ Excess 3 to BCD converter
5. AD converters using IC 741
6. Shift Register / Combinational Network Design and K-Map.
7. Wien's bridge and phase shift oscillators – using IC 741
8. Half, full wave rectifier and Doubler quadrapler.
9. FET Characteristics and Amplifiers.
10. Astable and Monostable multivibrator.
11. Half and Full Adder and subtractor / Johnson counters.
12. Binary to Grey and Grey to binary converter

unit IV-20%

III SEMESTER		
DSC7	QUANTUM MECHANICS II	18PCPH31
Hrs/Week : 5	Hrs/Sem : 75	Credits : 4

Preamble. Classical physics describes our everyday world very accurately and has done so for the past centuries. However, when we look very closely, that is, on the scale of molecules and atoms, things start to behave differently and we have to use a physical description that has become known as quantum theory. This course provides the perturbation theory, scattering theory and relativistic theory.

Prerequisites : Basic knowledge of fundamentals of quantum mechanics.

Objectives:

- To illustrate the inadequacy of classical theories and the need for a quantum theory.
- To explain the basic principles of quantum mechanics.
- To develop solid and systematic problem solving skills.
- To apply quantum mechanics to simple systems occurring in atomic and solid state physics.

UNIT I TIME INDEPENDENT PERTURBATION THEORY(15 hours)

Introduction- Theory for non degenerate case- First and second orders - Theory for degenerate case- Removal of degeneracy- Applications– Linear harmonic oscillator - First order Stark effect in Hydrogen atom- Variation method – Expectation value of the energy- Application to excited state-ground state of helium atom.

UNIT II TIME DEPENDENT PERTURBATION THEORY (15 hours)

Introduction- Perturbative solution for transition amplitude - constant perturbation- Transition probability per unit time (Fermi-golden rule) - Harmonic perturbation- adiabatic approximation- sudden approximation- Zeeman effect.

UNIT III SCATTERING THEORY (20 hours)

Kinematics of scattering process- Scattering amplitude and scattering cross section - Green's functions for scattering amplitude - Born approximation and its validity - Partial wave analysis –Scattering by a spherically symmetric potential- phase shift-differential and total cross sections- optical theorem- scattering by square well potential.

UNIT IV APPROXIMATION METHODS (13 hours)

Wentzel-Kramers-Brillouin (WKB) approximation method- Application of W.K.B method: Probability of penetrating of a barrier - Semi classical theory of radiation- Electric dipole approximation- Einstein transition probabilities for absorption and emission-Transition probability per unit time for spontaneous emission of a photon.

UNIT V:RELATIVISTIC QUANTUM THEORY (12 hours)

Schrödinger relativistic equation –Klein gorden equation-Charge and current densities- Difficulties-Dirac's relativistic equation – Dirac equation in an electromagnetic field- Probability and current density for dirac equation – Dirac matrices and their properties- Magnetic moment of the electron.

BOOKS FOR STUDY:

1. Sathya Prakash, Quantum Mechanics, Kendarnath Publiations.
2. P.M. Mathews and Venkatesan – A Text Book of Quantum Mechanics – Tata McGraw-Hill, New Delhi, (1976).
3. S. Rajasekar and R. Velusamy, Quantum Mechanics-Fundamentals-I & II, CRC Press, New York, 2005.

BOOKS FOR REFERENCE:

1. Powell J.L. and Craseman B., Quantum Mechanics Narosa Publishing, Madras, 1995.
2. V. Devanathan – Quantum Mechanics – Narosa Publishing House Pvt. Ltd., 2005, Chennai.
3. G. Aruldhas – Quantum Mechanics – Prentice – Hall of India, New Delhi 2002.
4. L.I. Schiff – Quantum Mechanics – Mc Graw Hill Book Company, New York, Third Edition, 2002
5. R.Shankar, Principles of Quantum Mechanics, 2nd Edition, Yale University, Springer.
6. Jasprit Singh, Modern Physics for Engineers, Willey Publications, 1999.

unit I - 2%

III SEMESTER		
DSC8	ELECTROMAGNETIC THEORY	18PCPH32
Hrs/Week : 5	Hrs/Sem : 75	Credits : 4

Preample: Electromagnetic theory is a prerequisite for a wide spectrum of studies in the field of Electrical Sciences and Physics. Electromagnetic theory can be thought of as generalization of circuit theory. There are certain situations that can be handled exclusively in terms of field theory. This course provides the fundamental formulation of electro and magnetostatics and electromagnetic waves and radiations.

Prerequisites : Knowledge of basic physics.

Objectives:

- To make the student understand the principles of electrostatics and magnetostatics.
- To enable the student to explore the field of electrodynamics.
- To make the student understand the basic concepts in Electromagnetic wave and radiation.
- To allow the student to have a deep knowledge of the fundamentals of Electromagnetism.

UNIT I ELECTROSTATICS (15 hours)

Coloumb's law- Gauss law- Poisson's equation and laplace's equation–Work done to move a point charge - Energy of a point charge and continuous charge distribution-Methods of images- Electric field in dielectric materials-Induced dipoles and polarizability- Clausius – Mossotti relation -susceptibility, permittivity and dielectric constant of linear dielectrics.

UNIT II MAGNETOSTATICS (13 hours)

Lorentz force law-Biot-Savart's law and Ampere's law-Magnetic vector potential -Multipole expansion of the vector potential- Effects of a magnetic field on atomic orbits-Bound current and its physical interpretations - Magnetic susceptibility and permeability in linear and non linear media.

UNIT III ELECTRODYNAMICS (15 hours)

Electromagnetic induction-Faradays law-Maxwell's equation differential and integral form- Boundary conditions on field vectors D,E,B and H- Scalar and Vector potentials-Gauge transformations- Lorentz and coulomb Gauge transformations-Poynting vector and Poynting theorem- Maxwell's stress tensors.

UNIT IV ELECTROMAGNETIC WAVES (18 hours)

Monochromatic plane waves- Energy and momentum of EM waves in linear media-Reflection and Transmission at normal and oblique incidence-EM waves in conductors- wave guides- TE waves in rectangular wave guide- The coaxial transmission line.

UNIT V ELECTROMAGNETIC RADIATION (14 hours)

Retarded Potential- Lenard wiechart potential-Electric dipole radiation-magnetic dipole radiation-Power radiated by a point charge- Larmor's formula -Abraham lorentz formula for the radiation reaction- The physical origin of radiation reaction

BOOKS FOR STUDY:

1. David J. Griffiths, Introduction to Electrodynamics, Printice-Hall India, New Delhi, Third Edition, 2006

2. P.Lorrain and D.Corson Introduction to Electromagnetic fields and waves LLC publishers (2013) New York.

3. J.R. Reitz, E.J. Milford and R.W.Chris Foundations of electromagnectic Theory , , Pearson publication, New York

4. U.A. Bakshi & A.V. Bakshi, Transmission Lines and Waveguides, 5th Revised Edition, Technical Publication, 2009.

BOOKS FOR REFERENCE :

1. J.D. Jackson, Classical Electrodynamics, John Wiley & Sons Inc., Singapore, Third Edition, 1998.

2. B.P Laud, Electrodynamics –New Age International Pvt. Ltd (1987), New Delhi.

No change

III SEMESTER		
DSC9	NUCLEAR AND PARTICLE PHYSICS	18PCPH33
Hrs/Week : 5	Hrs/Sem : 75	Credits : 4

Preample: The first part of the course will discuss nuclear physics. Properties of nuclei and details of popularnuclear models, properties of nuclear decays and nuclear reactions will be discussed in brief, but in a self-consistent manner. The second part will discuss the basics of particle physics. In this part, the fundamental forces and conservation laws.

Prerequisites : Basic knowledge of nuclear physics.

Objectives:

- To study the general properties of nucleus.
- To study the nuclear forces and nuclear reactions.
- To know about the theories and models of nucleus.
- To understand the concept of elementary particles.

UNIT I NUCLEAR FORCES (15 hours)

Deutron-Ground and excited states of deuteron-magnetic dipole and electric quadrupole moments of deuteron-n-p scattering at low energies – scattering length – phase shift analysis – The spin dependence of nuclear force- shape independent effective range theory of n-p scattering – p-p scattering at low energies- meson theory of nuclear force.

UNIT II NUCLEAR DECAYS (15 hours)

Gamow's theory of alpha decay - Fermi theory of beta decay – Beta ray spectrum - Fermi and Gamow-Teller selection rules – parity violation – neutrino hypothesis –internal conversion – nuclear isomerism.

UNIT III NUCLEAR MODELS (20 hours)

Liquid drop model – Weizsackers mass formula – mass parabola – nuclear stability – Bohr Wheeler theory of nuclear fission -magic numbers -evidence for magic numbers – shell model – spin orbit coupling – angular momenta and parities of nuclear ground states – magnetic moments - collective model.

UNIT IV: NUCLEAR INTERACTION (13 hours)

Types of nuclear reactions – Nuclear reaction Kinematics: Q-equation - compound nuclear theory - Reciprocity theorem – nuclear cross section – Resonance Scattering - Breit Wigner one level formula – nuclear chain reaction – four factor formula.

UNIT V: ELEMENTARY PARTICLES (12 hours)

Classification of elementary particles - fundamental interactions - Conservation laws - CPT theorem - SU(3) multiplet – meson octet – baryon octet - baryon decouplet – Gellmann-Okubo mass formula - Quark theory.

BOOKS FOR STUDY:

1. Nuclear Physics, D.C.Tayal, Himalaya Publications, New Delhi (1980) (Unit 1,2,3,4,5).

2. Elements of Nuclear Physics, M.C Pandia and R.P.S Yadav Kedarnath, (1972).

3. Nuclear Physics, R.R.Roy and B.P Nigam, New Age International Ltd, New Delhi (1992).

BOOKS FOR REFERENCE:

1. Concepts of Nuclear Physics, Bernard Lcohen, Tata - MC.Graw – Hill, New Delhi (1995).

2. Nuclear Physics an Introduction , S.B Patel , Wiley –Eastern Ltd, New Delhi (2001).

New paper-100%

	III SEMESTER	
DSE-3A	NONLINEAR DYNAMICS	18PEPH3A
Hrs/Week : 4	Hrs/Sem : 60	Credits :4

Preample: In this course we introduce the basic ideas of nonlinear dynamics and chaos in classical systems modelled by ordinary differential equations and iterated maps. The level of treatment is not too physics-specific, and students of other departments can also benefit from it. Apart from physical systems, examples are also taken from chemistry and biology.

Prerequisites : Basic knowledge of physics.

Objectives:

- To explore the theoretical understanding of dynamical systems, dissipative systems and Hamiltonaian systems.
- To introduce the students to Chaos and Fractal geometry with an emphasis on the physical Aspects.

UNIT I: Linear, Nonlinear oscillators and Nonlinearity(12 hours)

Dynamical systems-linear and nonlinear forces-Mathematical implications of nonlinearlty- Working definition of nonlinearity-Effects of nonlinearity-Linear oscillators and predictability- Damped and driven nonlinear oscillators.

UNIT II: Equilibrium points, Bifurcations and Chaos(12 hours)

Equilibrium points-General criteria for stability-Classification-Some simple bifurcations -Saddle node, pitch fork, transcritical and Hopf bifurcations-Discrete dynamical systems-Logistic map-Equilibrium points and their stability-period doubling phenomenon-chaos.

UNIT III: Chaos in Nonlinear Electronic Circuits:(12 hours)

Linear and nonlinear circuit elements-nonlinear circuits-Chua's diode-Autonomous case-Bifurcations and chaos-Chaotic dynamics of MLC circuit-Analogue circuit simulation-Discrete Chaotic Circuits-Time delay-Systems- Colpitt's oscillator.

UNIT IV: Fractals and Cellular Automata: (10 hours)

Self similarity-Properties and examples of fractals-Fractal dimension-Construction and properties of some fractals-Middle one third cantor set-Koch curve-Sierpinski triangle-Julia set-Mandelbrot set-Applications of fractals-Cellular Automata-Fractal Structure-Applications.

UNIT: V Solitons: (14 hours)

Linear waves-Linear non dispersive wave propagation-Linear dispersive wave propagation-Nonlinear dispersive systems-Korteweg de Vries equation- solitary and

cnoidal waves-Numerical experiments of Zabusky and Kruskal-birth of solitons—Properties of solitons-applications of solitons.

BOOKS FOR STUDY:

1. M. Lakshmanan and S.Rajasekar, Nonlinear dynamics, Integrability, Chaos and Patterns,Springer, Berlin, 2003.
2. Deterministic Chaos, H.G.Schuster, Verlag,Weinheim,1998.
3. A.J. Lichtenberg and M.A. Lieberman : Regular and Stochastic Motion, Verlag, Weinhreim,1998.

BOOKS FOR REFERENCE:

1. Chaos in nonlinear oscillator, controlling and synchronization, M.Lakshmanan and K.Murali. World Scientific, Singapore,(1997).
2. R.L.Devaney : Introduction to Dynamical System, World Scientific, Singapore,1997.
3. Stephen Wolfram, A New Kind Of Science, 1st Edition, 2002.

New paper-100%

III SEMESTER		
DSE-3B	CRYSTAL GROWTH AND THIN FILMS	18PEPH3B
Hrs/Week : 4	Hrs/Sem : 60	Credits :4

Preamble: In this course various growth techniques discussed in the first three chapters are a useful guide to materials synthesis.. The existence of a well-defined melting point is necessary for the growth of single crystals that are needed only in special circumstances such as single – crystal neutron diffraction studies. Various deposition techniques of thin films and some characterization techniques are also discussed in this course.

Prerequisites : Basic knowledge of solid state physics.

Objectives:

- To provide a qualitative idea on the fundamentals of growing crystals and characterizing the grown samples.
- This paper will serve as an eye opener for students keen in research activities particularly in experimental physics.

Unit I: Solution Growth Technique (12 hours)

Low temperature solution growth: Solution – Solubility and super solubility – Expression of super saturation – Miers T-C diagram. Constant temperature bath – Seed preparation and mounting – Slow cooling and solvent evaporation methods.

Unit II: Gel Growth Techniques (12 hours)

Principle – various types – Structure of gel – Importance of gel – Experimental procedure- Chemical reaction method – single and double diffusion method- Chemical reduction method – Complex and decomplexion method – Advantages of gel method.

Unit III: Other Growth Techniques: Melt Technique: (12 hours)

Vertical Bridgman technique–Basic process–various crucible design–Thermal consideration– Czochralski technique–Experimental arrangement – Growth process-Physical vapour deposition–Chemical vapour deposition.

Unit IV:Thin Film Deposition Techniques (14 hours)

Thin films–Introduction to Vacuum Technology–Deposition Techniques–Physical Methods–Resistive Heating, Electron beam Gun, Laser Gun Evaporation and Flash Evaporations. Sputtering:Reactive Sputtering- Radio Frequency Sputtering–Chemical methods :Spray Pyrolysis.

Unit V:Characterization Technique (10 hours)

X-ray Diffraction (XRD)–Powder and single crystal–Fourier transform infrared analysis –Atomic absorption spectroscopy. Scanning Electron Microscopy (SEM) – UV– VIS Spectrometer –Vickers Micro hardness tester.

BOOKS FOR STUDY:

1. P. Shanthana Ragavan and P. Ramasamy, Crystal Growth Processes and Methods (KRU Publications, Kumbakonam, 2001)
2. A. Goswami, Thin Film Fundamentals (New Age International (P) Limited, New Delhi, 1996)
3. J.C. Brice, Crystal Growth Processes (John Wiley and Sons, New York 1986).

BOOKS FOR REFERENCES:

1 Brice J. C. (1986), 'Crystal Growth Process', John Wiley and Sons, New York.

1. R.A. Stradling & P.C.Klipstein, Growth and Charaterization of Semiconductors, Adam Hilser, Bristol, 1990.
3. Buckley H.E. (1951), 'Crystal Growth', John Wiley and Sons, New York.
4. Pamplin B.R. (1980), 'Crystal Growth', Pergman Press, London

Experiment 8,10,11,12 added - 25%

III SEMESTER		
P-V	ADVANCED PHYSICS EXPERIMENTS - I	18PCPH3P1
Hrs/Week : 4	Hrs/Sem : 60	Credits : 2

Course Objectives: To study/perform some experiments in physics.

- To determine the resistivity and the band-gap of the given semiconductor sample using four probe technique.
- Determine the Hall coefficient for given semiconductor and determine the dopant density and mobility for majority charge carriers.
- Determine the band-gap of the given p-n junction using reverse saturation current.

(Any Eight)

1. Hall effect
2. Elliptical fringes
3. Temperature variation of forward bias voltage for Ge & Silicon
4. Ultrasonic Diffraction – compressibility of liquid
5. Susceptibility – Guoy's method
6. Thickness of the enamel coating on a wire by diffraction using He –Ne Laser source
7. Determination of Miller indices and lattice parameter of an unknown powder material by X-ray diffraction.
8. Iodine absorption spectrum-Spectroscopic constants.
9. Young's double slit experiment.
10. Dielectric constant of solids.
11. Study of FTIR spectrum and TGA.
12. Analysis of UV-Visible Spectrum

Experiment10,11,12 added - 25%

III SEMESTER		
P- VI	MICROPROCESSOR PROGRAMMING	18PCPH3P2
Hrs/Week : 4	Hrs/Sem : 60	Credits : 2

Course Objectives:

- To provide theoretical knowledge and develop practical skill in digital systems, logic systems and Microprocessor.
- To study the Architecture of 8085 microprocessor.

(Any Eight)

1. Block Move, addition, subtraction, logical operations. (8085/8086).
2. Block Move, multiplication and Division Operations (8085/8086).
3. Rearranging the numbers- ascending, descending (8085/8086)
4. Rearranging the numbers- maxima, minima and searching a character of an array (8085/8086).
5. Counters using seven segment LED Display (8085/8086)
6. Simple series Generation- Fibonacci, Tribonacci etc. (8085/8086)
7. Display of any number-rolling display (8085/8086)
8. Analogue to digital converter and digital to analogue converter (ADC & DAC)
9. Waveform generation (Square, sine ,Triangular) (8085/8086)
10. Microprocessor 8085-Interface (Stepper motor control).
11. Microcontroller: Controlling LED with switch.
12. Microcontroller: DC motor control.

unit V - 20%

IV SEMESTER		
DSC10	SOLID STATE PHYSICS	18PCPH41
Hrs/Week : 5	Hrs/Sem : 75	Credits :4

Preamble : This course provides an introduction to a bunch of basic phenomena that collectively define Condensed Matter Physics or Solid State Physics. Emphasis will be given on developing a coherent path for understanding the set of rather diverse phenomena.

Prerequisite: This being a core course does not really define prerequisites, but the knowledge of Quantum and Statistical mechanics play pivotal roles in developing concepts for this course along with other courses taught up to IInd year of study in M.Sc(Physics) at SAC.

Objectives:

- To understand the basic knowledge of crystal structures and crystal systems.
- To understand the various techniques available using X-Ray Crystallography.
- To comprehend the concepts of superconductivity and magnetic properties of solids.

UNIT I: RECIPROCAL LATTICE AND ENERGY BANDS (15 hours)

Diffraction of waves by Crystals – Bragg's law – Scattered wave amplitude – reciprocal lattice vectors – Brillouin zones – Fourier analysis of the basis –Bloch function – Kronig penney model – Wave equation of electron in a periodic potential – Number of orbits in a band.

UNIT II: CRYSTAL VIBRATIONS (15 hours)

Vibration of crystals with mono atomic basis – Two atoms per primitive basis – Quantization of elastic waves – Phonon momentum – Inelastic scattering by phonons – Phonon heat capacity – Density of states in one and three dimensions – Debye model for density of states – Einstein model of the density of states – Thermal conductivity – Thermal resistivity of phonon gas.

UNIT III: FREE ELECTRON FERMI GAS AND FERMI SURFACES (18 hours)

Energy levels in one dimension – Effect of temperature on the Fermi Dirac distribution – Free electron gas in three dimension – Heat capacity of the electron gas – Electrical conductivity and ohm's law – Motion is magnetic fields – Fermi surface and its Construction.

UNIT IV: DIA, PARA AND FERROMAGNETISM (13 hours)

Langevin's diamagnetic equation – Quantum theory of diamagnetism and paramagnetism – Hund's rule – Paramagnetic susceptibility of conduction electrons – Ferromagnetic order – Magnons – Ferrimagnetic order –Ferromagnetic domains.

UNIT V: DIELECTRICS, FERROELECTRICS AND SUPER CONDUCTIVITY (14 hours)

Macroscopic electric field - Local field at an atom - Dielectric constant and polarizability - Ferroelectric crystals -Ferroelectric domains - Piezoelectricity - occurrence of superconductivity -Meissner effect - thermodynamics of superconducting transition - London equation - coherence length - BCS theory of superconductivity - single particle tunneling - DC Josepson and AC Josepson effects.

BOOKS FOR STUDY:

1. Introduction to Solid State Physics, Charles Kittel, 7 Edition, John Wiley & Sons, New York, 1996. (Chapters: 2,4,5,6,7,9,,14,15,18,19,20)
2. Solid State Physics, S.O.Pillai ,Revised 6 th Edition, New Age International Publishers 2007, New Delhi.

BOOKS FOR REFERENCE:

1. Elementary Solids State Physics, M.Ali Omar, Pearson Education, 1999, New Delhi.
2. Introductory Solids State Physics, H.P.Myres 2nd Edition, Taylor and Francis Ltd, London (2001).

New paper-100%

IV SEMESTER		
DSC11	RESEARCH METHODOLOGY	18PCPH42
Hrs/Week : 5	Hrs/Sem : 75	Credits :4

Preamble. In order for students to propose new research title or topic will never be easy. We need to squeeze the brain, generating ideas and find exactly what we want. This course will serve as an eye opener for students keen in research activities particularly in physics.

Prerequisites: To enrol in this subject, you must be admitted in M.Sc Physics. Basic knowledge of plotting and type setting softwares

Objectives:

- To provide a qualitative idea on the fundamentals of research and types and methods of research.
- This paper will serve as an eye opener for students keen in research activities particularly in physics.

Unit I: Foundation of Research and Types of Research (15 hours)

What is Research- Objectives of Research- Scientific Research- Characteristics of research-Types of Research: Pure -Applied Research- Action Research. Descriptive Research- Steps involved in research process.

Unit II : Review of Literature and Planning of Research (15 hours)

Need for Reviewing Literature- Literature Search Procedure- Sources of Literature- Planning of Review work- Selection of a Problem for Research- Formulation of the Selected Problems- Hypothesis formation- Research Design/Plan. Role of research supervisor.

Unit III: Report writing: (15 hours)

Preliminary pages: Title page- Certificate-Declaration-Acknowledgement-Table of content. Main body of the report: objectives-hypothesis-Chapterization. BOOKS FOR REFERENCE Section: language and style of writing- Footnote citations- Quotations- Abbreviations. Format of synopsis writing.

Unit IV: Plotting software: Origin (15 hours)

Introduction - Importing your data - Plotting Data - Customizing the Data Plot - Customizing the Graph Axes -Adding Text to the Graph - Exploring Data: Transforming Column Values - Sorting Worksheet Data - Plotting a Range of the Worksheet Data - Performing a Linear Fit - Creating Multiple Layer Graphs– Working with Excel in Origin.

Unit : V : Microsoft Word-2010 (15 hours)

Introduction – Working with text – Formating the text – Searching for and replacing text – Working with headers and footers – Text – Styles – Text Proofing and Translating – Working with Pictures and Watermarks – Page setup and Printing – Handwriting text.

BOOKS FOR STUDY:

1. Research Methodology: Methods and Techniques by C. R. Kothari, New Age International
Publishers, ISBN:81-224-1522-9,New Delhi.
2. Research Methodology by S.Rajasekar, P.Philominathan and V. Chinnathambi, RPC
Publications, Tirunelveli-11, 2016.
3. http://www.physics.rutgers.edu/~eandrei/389/Origin6_Tutorial.pdf
4.Stephen Copestake, "Office XP in easy steps", Dreamtech Press, Daryaganj, New Delhi, 2009.

BOOKS FOR REFERENCE:

1. Research Methodology – Text and Cases with SPSS Applications, by Dr S.L. Gupta and Hitesh Gupta, International Book House Pvt Ltd, New Delhi, 1999.
2. Business Research Methodology by T N Srivastava and Shailaja Rego, Tata Mc graw Hill Education Private Limited, New Delhi, (1998).
3. Research Methodology in Education, by Dr.K.Nagarajan, Ram publishers,Chennai 2009.
3. Methodology of Research in Social Sciences, by O.R. Krishnaswami, Himalaya Publishing.

IV SEMESTER		
DSC12	PROJECT (P)	18PCPH43
Hrs/Week : 8	Hrs/Sem : 120	Credits : 8

Objective: Every PG student is required to prepare the project subject related – based on the guidelines of his/her project guide.

The following are the guidelines to be adhered to

- The project should be an individual one
- The language for the project is **English**
- The Minimum number of pages should be **60**
- Project observations, suggestions and conclusion shall be formed as part of the project.
- The Project will be evaluated both by the Internal as well as External Examiner each for 100 marks. The distribution of mark should be **60 marks for the Project Report and 40 marks for the Viva-voce Examination**. The Division of marks for the Project Report is as mentioned below:

Particulars	Internal Examiner	External Examiner
Wording of Title	5	5
Objectives/ Formulation including Hypothesis	5	5
Review of Literature	10	10
Relevance of Project to Social Needs	5	5
Methodology/ Technique/ Procedure Adopted	20	20
Summary/ Findings/ Conclusion/Future recommendations.	5	5
Bibliography/ Annexure/ Foot notes	10	10
Total	**60**	**60**

The average mark of Internal and External Examiner is considered as marks of Dissertation report

No change

IV SEMESTER		
DSE-4A	OPTO ELECTRONICS AND LASERS	18PEPH4A
Hrs/Week : 4	Hrs/Sem : 60	Credits :4

Preamble: Lasers and Opto-electronics play an ever growing role in all walks of modern life, be it in communication, entertainment, manufacturing or instrument. Optoelectronics covers but is not limited to the following topics: Optical and optoelectronic materials; Light sources, including LEDs, lasers and holography.
Prerequisites : Basic knowledge of light wave fundamentals, Lasers, fiber physics.
Objectives:

- To understand the general scientific concepts in fiber optic communication.
- To study the design techniques for fiber optic guides.
- To study the laser principle and sources.
- To study the principle and types of Holography.

UNIT I: LIGHT WAVE FUNDAMENTALS(12 hours)

Electromagnetic waves – Dispersion – Pulse distortion –Information rate – Material dispersion and Pulse distortion- Polarization – Resonant cavities – Reflection at a plane boundary – Critical angle reflections.

UNIT II: LASERS(12 hours)

Laser Principles: Absorption process, Emission process – Einstein relation – Laser operation: Population inversion and derivation of threshold gain K_{th} - Population inversion and pumping threshold conditions - Mode locking – Active mode locking – Passive mode locking – Q Switching methods: Rotating mirror type Q switching- Q switching using an electro optical switch.

UNIT III: LASER SOURCES & DETECTORS(12 hours)

Types of lasers – Ruby laser – Nd:YAG laser – Nd:Glass lasers – He:Ne laser – Co_2 laser – laser diodes- Light detectors – Principles of Photo detector – Photo multiplier – Semiconductor photo diode – PIN photo diode – Avalanche Photodiode.

UNIT IV: Wave equation in Step Index Fiber (12 hours)

Step index fiber – Graded index fiber – Attenuation in fiber – Modes in step index fiber – Modes in graded index fiber- Pulse distortion and information rate in optic fiber – Construction of optical fiber cables – Testing of Fibre cable.

UNIT V: HOLOGRAPHY(12 hours)

Basic operating principle of holography – Gabor hologram and its limitations – practical problems in holography – types of holograms – Fresnel and Fraunhofer holograms – Transmission and Reflection holograms – Multiplex hologram – Application of holography.

BOOKS FOR STUDY:

1. Joseph C. Palais , Fibre Optic Communication, Fifth edition, Prentice Hall publication, New Delhi, 1998.
2. Optoelectronics, J. Wilson and J.F.B. Hawkes, Prentice Hall Publication, New Delhi, 1995.
3. Laser & Optical Instrumentation, S.Nagabhushana, N.Sathyanarayana - I.K.International Publishing House Pvt.Ltd, New Delhi, 2005.

4. William T. Silfvast, Laser Fundamentals, 2nd Edition, Cambridge University Press, Cambridge, 2004.

BOOKS FOR REFERENCE:

1. Photonics Optical Electronics in Modern Communication, Ammon Yariv and Pochi Yeh, Oxford University press. London, 1994
2. Optical fibers and fiber Optics, Communication System's Subir Kumar Sakar, S. Chand & Co. New Delhi, 2001
3. Introduction to fiber optics, Ajay Ghatak and K. Thiagarajan, Tata Mc Graw Hill, NewDelhi, 1998.

No change

IV SEMESTER		
DSE-4B	MATERIALS SCIENCE	18PEPH4B
Hrs/Week : 4	Hrs/Sem : 60	Credits :4

Preamble: Every segment of human civilization is influenced by various materials. The development and advancement of societies are related to their ability to produce and manipulate materials to fulfill their needs. Engineers are frequently exposed to design problems involving materials, such as, selection of the right material from many available materials. This course involves investigating the relationships that exist between processing, structure, property and performance of materials.

Prerequisites : Basic knowledge of condensed matter physics.

Objective : This paper aims to give an understanding of the structural aspects and some of the physical properties of materials from a microscopic view point.

UNIT I: CRYSTALLINE MATERIALS (12 hours)

Introduction – Crystal symmetry- Simple crystal structures- Polymorphism and allotropy-Crystal directions- Crystal imperfections- Structure determination by x-ray diffraction-Bragg's law-determination of lattice parameters (Bragg's x-ray spectrometer method) - The laue's method-The powder method.

UNIT II: CONDUCTING MATERIALS (10 hours)

Introduction- The classical free electron theory-Wiedmann-Franz law- The quantum free electron theory – Fermi distribution function-Density of energy states- Electrons in the periodic potentials –Conductors- High resistivity materials.

UNIT III: SEMICONDUCTING MATERIALS (12 hours)

Introduction- Elemental intrinsic semiconductors - Carrier concentration in intrinsic semiconductors - Extrinsic semiconductor - Carrier concentration in N-type and P-type semiconductors- Semiconductor materials-Hall effect-Applications

UNIT IV: CERAMICS AND GLASSES (12 hours)

Introduction- Traditional ceramics – Advanced ceramics- Types of ceramics- Natural ceramic materials- Glass manufacturing-glass properties- Heat treatment of glass- Types of glasses and their applications.

UNIT V: ELECTRICAL MATERIALS (14 hours)

Introduction- Good conductors- Dielectric behavior – Piezo Electric materials – Ferroelectric materials- pyroelectric materials.

BOOKS FOR STUDY:

1. Materials Science and Engineering-A First Course V.Raghavan Fifth Edition Prentice Hall of India, New Delhi,2011
2. William F Smith, JavadHashemi, Materials Science and Engineering in SI units, Tata McGraw Hill Education Private Limited, Fourth edition, 2011.
3. Charles Kittel, Introduction to Solid State Physics, 7th Edition, John Willey Publications.
4. R. Balasubramaniam, Callister's Materials Science and Engineering, 2nd Edition, Willey Publications, 2014.

BOOKS FOR REFERENCE:

1. A text book of Material Science and metallurgy O P Khanna Dhanpat R Publications 2013
2. M.Arumugam, Materials Science, Anuradha Publications, Kumbakonam,2002.

Experiment 7,9,11,12 added - 25%

IV SEMESTER		
P-VII	ADVANCED PHYSICS EXPERIMENTS - II	18PCPH4P1
Hrs/Week : 4	Hrs/Sem : 60	Credits :2

Objective :

- To determine the resistivity and the band-gap of the given semiconductor sample using four probe technique.
- Determine the Hall coefficient for given semiconductor and determine the dopant density and mobility for majority charge carriers.
- Determine the band-gap of the given p-n junction using reverse saturation current.

(Any Eight)

1. Dielectric constant of liquids
2. Equipotential surface –different shapes
3. Band gap energy - Thermistor / Semiconductor
4. Calibration of Hall probe in to Gauss meter using search coil
5. Michelson interferometer-wave length and determination in wave length of Sodium light.
6. Resistivity – Four probe method.
7. Determination of Fermi energy(E_F) – Metal wires (atleast three wires)
8. Determination of Lattice parameters, particles sizes etc. of different powder samples of bulk-/nano-systems using X-ray diffractometer.
9. Electro deposition of semiconducting thin films
10. Fraunhofer diffraction using laser.
11. Measurement of Absorption coefficient of material (Supplied) using Laser light.
12. Measurement of Brewster's angle of a substance and hence determine the Refractive index

Experiment 4,6,10,11,12 - 30%

IV SEMESTER		
P-VIII	NUMERICAL METHODS AND C++ PROGRAMMING	18PCPH4P2
Hrs/Week : 4	Hrs/Sem : 60	Credits : 2

Objective :

- Basic mathematical methods which are required for physics problems are introduced
- Introducing simple numerical method on polynomial and expose to numerical calculus.
- To be able to write programmes by using C++coding

(Any Eight)

1. Curve fitting to straight line and data interpolation (Cauchy's constant)
2. Currents in wheatstone's bridge – solution of simultaneous equations (Gauss elimination)
3. Solution of radioactive decay problem (or any physics problem) Use Runge kutta.
4. Solution of radioactive decay problem (or any physics problem) Use Euler' methods.
5. Evalution of area under the curve-Simpsons' rule.
6. Evalution of area under the curve- monte-carlo method.
7. Eigen values and eigen vectors of symmetry matrices.
8. Matrix multiplication (application – rotation matrices).
9. Newton's Law of cooling (or any physics problem) using numeric differentiation.
10. Solution of transcendental equations by the Newton's-Raphson method
11. Solution of polynomial equations by the Newton's-Raphson method
12. Write a C++ program to find the (i) roots of the quadratic equation

unit V - 20%

IDC SUBJECTS OFFERED BY DEPARTMENT OF PHYSICS TO OTHER MAJOR STUDENTS

II SEMESTER		
IDC-1	RENEWABLE ENERGY	18PIPH21
Hrs/Week : 3	Hrs/Sem : 45	Credits :3

Preamble: Renewable energy is energy that is collected from renewable resources, which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat. A renewable resource is a resource, which can be used repeatedly and replaced naturally.

Prerequisites : Basic knowledge of Solar energy, Wind energy and Applications of Biomass.

Objectives:

- Acquire the knowledge of Energy Sources.
- To know the Renewable energy resources and significant opportunities for energy efficiency.
- To study the design techniques of Solar collector and its applications.

UNIT I: INTRODUCTION TO ENERGY SOURCES (9 hours)

Energy Sources – Types of energy sources – World energy futures – Energy sources and their availability – Prospects of Renewable energy sources.

UNIT II: SOLAR ENERGY (9 hours)

Introduction –Physical principles of the conversion of solar radiation into heat - Solar energy Collector- Flat plate collector – Concentrating collector – Advantages and disadvantages of concentrating collectors over flat plate collectors.

UNIT III : WIND ENERGY (9 hours)

Introduction – Power from the wind – Types of Wind Machines – Advantages and Disadvantages of wind energy.

UNIT IV : OCEAN THERMAL ENERGY (9 hours)

Introduction – Methods of Ocean thermal electric power generation – Open cycle OTEC system – Closed cycle OTEC system.

UNIT V: BIOCONVERSION AND BIOMASS (9 hours)

Introduction – Photosynthesis – Biogas generation – Digester and their designs – Advantages and disadvantages of Bio-logical conversion of solar energy – Applications of Bio-Gas.

BOOKS FOR STUDY:

5. Non-Conventional Energy Sources by G.D.Rai, Khana Publiation, New Delhi (1988).
6. Alternate energy sources by T.N.Veziroglu, Vol.5 and 6, MGraw-Hill (1978).

BOOKS FOR REFERENCE:

1. Solar Energy by S.P.Sukhatme, Tata Mc. Graw Hill.
7. Solar energies of Thermal processes by A.Duffie and W.A.Becjmann, John-wily (1980).
8. Principle of Solar engineering by F.Krith and J.F.K. Krcider, McGraw-Hill (1978).

New paper-100%

III SEMESTER		
IDC-2	DIGITAL ELECTRONICS	18PIPH31
Hrs/Week : 3	Hrs/Sem : 45	Credits :3

Preamble: **Digital electronics** are electronics that operate on digital signals. Digital techniques are helpful because it is a lot easier to get an electronic device to switch into one of a number of known states than to accurately reproduce a continuous range of values.

Prerequisites: Basic knowledge of Number system and codes, Boolean algebra and Data converters.

Objectives:

- Acquire knowledge about analog and digital electronic devices and circuits.
- Acquire knowledge about sensors and transducers
- Apply circuit theory to design analog and digital circuits

UNIT I Number system and codes (9 Hours)

Binary, Octal, Hexadecimal – inter conversion – Gray code – excess 3-code – ASCII code – basic gates – DeMorgan's theorem – universal gates.

UNIT II Boolean algebra (9 Hours)

Laws of Boolean algebra – solving Boolean expression – K-map –minterms– SOP – K-map simplification using minterm (2, 3 and 4variables) – POS – K-map simplification using max terms (2, 3 and 4variables) – incomplete specified functions.

UNIT III Arithmetic and logic circuits (9 Hours)

Half adder – Full adder – Half subtractor – Full subtractor – Decoder –BCD to seven segment decoder – Encoder – decimal to BCD encoder –multiplexer – applications – de-multiplexer.

UNIT IV Sequential circuits (9 Hours)

RS Flip flop using NOR and NAND gates – clocked RS flip flop – D flipflop – JK flip flop – Master Slave JK flip flop – Registers – Shift Registers (right to left and left to right) – applications.

UNIT V Counters and data converters (9 Hours)

Counters – modulus of a counter – asynchronous counter (4-bits) –synchronous counter (3-bits) – BCD counter – D/A conversion – R-2Rbinary ladder method – A/D conversion – successive approximation.

BOOKS FOR STUDY:

1. Don Leach, Albert Malvino, Digital principles and applications, McGraw-Hill Inc., US (1994).
2. V. Vijayendran, Digital fundamentals. S. Viswanathan Printers and Publishers Pvt. Ltd., (2009).
3. Virendra Kumar, Digital electronics, New Age International Publishers (2007).

BOOKS FOR REFERENCE :

1. Avinashi Kapoor and L. K. Maheswari, Digital Electronics - Principles and Practice, Macmillan India Limited (2004).
2. D. A. Godse and A.P. Godse, Digital electronics, Technical Publlsher, Pune (2008).
3. Morris Mano, Digital Logic and Computer Design, Pearson Education (2004).

IDC COURSES (2018 – 2021)							
SEM	TITLE OF THE PAPER	S. CODE	H/W	C	MARKS		
					I	E	T
DEPT. OF ENGLISH							
II	CREATIVE WRITING	18PIEN21	3	3	25	75	100
III	ENGLISH FOR BUSINESS COMMUNICATION	18PIEN31	3	3	25	75	100
DEPT. OF HISTORY							
II	INDIAN HISTORY FOR COMPETITIVE EXAMINATIONS (1526- 1707A.D)	18PIHS21	3	3	25	75	100
III	INDIAN HISTORY FOR COMPETITIVE EXAMINATIONS (1707-1947 A.D)	18PIHS31	3	3	25	75	100
DEPT. OF COMMERCE							
II	BASIC ACCOUNTING SKILL	18PICO21	3	3	25	75	100
III	HUMAN RESOURCE MANAGEMENT	18PICO31	3	3	25	75	100
DEPT. OF MATHEMATICS							
II	ADVANCED DISCRETE MATHEMATICS	18PIMA21	3	3	25	75	100
III	NUMERICAL & STATISTICAL METHODS	18PIMA31	3	3	25	75	100
DEPT. OF CHEMISTRY							
II	INDUSTRIAL CHEMISTRY	18PICH21	3	3	25	75	100
III	INTRODUCTION TO CHEMINFORMATICS	18PICH31	3	3	25	75	100
DEPT. OF COMPUTER SCIENCE							
II	INTERNET CONCEPTS AND WEB DESIGN	18PICS21	3	3	25	75	100
III	DESKTOP PUBLISHING	18PICS31	3	3	25	75	100
DEPT. OF MICROBIOLOGY							
II	MICROBIOLOGY AND HUMAN HEALTH	18PIMB21	3	3	25	75	100
III	ENTREPRENEURSHIP IN MICROBIOLOGY	18PIMB31	3	3	25	75	100
DEPT. OF PHYSICS							
II	RENEWABLE ENERGY	18PIPH21	3	3	25	75	100
III	DIGITAL ELECTRONICS	18PIPH31	3	3	25	75	100
DEPT. OF ZOOLOGY							
II	MUSHROOM CULTURE	18PIZO21	3	3	25	75	100
III	POULTRY AND DAIRY SCIENCE	18PIZO31	3	3	25	75	100

SCHEME OF EXAMINATIONS UNDER CBCS

The medium of instruction in all PG courses is English and students must write the CIA Tests and Semester Examinations in English.

DISTRIBUTION OF MARKS FOR CIA AND SEMESTER EXAMINATIONS FOR POSTGRADUATE COURSES

SUBJECT	TOTAL MARKS	CIA TEST	SEMESTER EXAMINATION	PASSING MINIMUM		
				CIA EXAM.	SEM. EXAM.	OVER ALL
Theory	100	25	75	Nil	38	50
Practical (6 hrs.)	100	40	60	Nil	30	50
Practical (4 hrs.)	50	20	30	Nil	15	25
Project	100	nil	Report - 60 marks Viva Voce - 40 marks	Nil	Nil	50

DIVISION OF MARKS FOR CIA TEST

SUBJECT	MARKS	ASSIGNMENT OR SEMINAR FOR PG	RECORD NOTE	TOTAL MARKS
Theory	20	5	--	**25**
Practical (6hrs)	30	--	10	**40**
Practical (4hrs)	15	--	5	**20**

1. The duration of each CIA Test is ONE hour and the Semester Examination is THREE hours.
2. Three CIA tests of 20 marks each will be conducted and the average marks of the best two tests out of the three tests will be taken.
3. The I test will be based on the first 1.5 units of the syllabus, the II test will be based on the next 1.5 units of the syllabus and the III test will be based on the next 1.5 units of the syllabus.
4. Two assignments for Undergraduate, Certificate, Diploma and Advanced Diploma Courses and two assignments OR two seminars for Postgraduate Courses has to be submitted.
5. The duration and the pattern of question paper for practical examination may be decided by the respective Boards of Studies. However, out of 60 marks in the semester practical examination, 10 marks may be allotted for record and 50 marks for practical.
6. Two internal practical tests of 30/15 marks each will be conducted for science students in the respective semester and the average will be taken. The record marks allotted for the above practicals are 10 and 5 respectively.

QUESTION PAPER PATTERN FOR CIA TEST (THEORY)

Duration: 1 Hr **Maximum Marks: 20**

Section	Question Type	No. of Questions & Marks	Marks
A	No Choice Answer should not exceed 75 words	2 Questions 2 marks each	2 x 2 = 4
B	Internal choice (Either or type) Answer should not exceed 200 words	2 Questions 4 marks each	2 x 4 = 8
C	Open Choice (Answer ANY ONE out of Two) Answer should not exceed 400 words	1 Question 8 marks	1 x 8 = 8
		TOTAL	**20 MARKS**

QUESTION PAPER PATTERN FOR SEMESTER EXAMINATION (THEORY)

Duration: 3 Hrs **Maximum Marks: 75**

Section	Question Type	No. of Questions & Marks	Marks
A	No Choice Answer should not exceed 75 words	10 Questions - 2 marks each (2 Questions from each unit)	10 x 2 = 20
B	Internal choice (Either or type) Answer should not exceed 200 words	5 Questions with internal choice. Each carries 5 marks (Two questions from each unit)	5 x 5 = 25
C	Open Choice (Answer ANY THREE out of FIVE) Answer should not exceed 400 words	3 Questions out of 5 - 10 marks each (1 Question from each unit)	3 x 10 = 30
		TOTAL	**75 MARKS**

SADAKATHULLAH APPA COLLEGE

(AUTONOMOUS)

(Reaccredited by NAAC withan 'A' Grade with a CGPA of 3.40 out of 4.00 in the III cycle An ISO 9001:2015 Certified Institution)

RAHMATH NAGAR, TIRUNELVELI- 11,

Tamilnadu

PG AND RESEARCH DEPARTMENT OF PHYSICS

(Unaided)

CBCS SYLLABUS

For

M.Phil. PHYSICS

(Applicable for students admitted in June 2018 and onwards)

(As per the Resolutions of the Academic Council Meeting held on 17.10.2018)

REGULATIONS

FULL – TIME

1. PROGRAM OBJECTIVES:

The programme is named as Master of Philosophy (M.Phil.,) in Physics. This programme is offered under Choice Based Credit System (CBCS). The CBCS enables the students to select variety of subjects as per his/her interest and requirement. Acquiring knowledge in the related fields is advantageous to the students. The programme is structured in such a way to impart more knowledge in science, in particular in Physics. Physics is the natural science that involves the study of matter and its motion through space and time along with the related concepts such as energy and force. It is one of the most fundamental scientific disciplines. The main goal of Physics is to understand how the universe behaves. Physics explains the natural phenomena in the universe and often considered to be the most fundamental science. It provides a basis for all other sciences - without Physics, we could not have Biology, Chemistry, or anything else. Physics also makes significant contributions through advances in new technologies. One academic Programme is necessary to create awareness to students in the emerging field and also it should teach basic concepts and developments of Physics to students to make them as scientist or technologists in this field. Hence our task is to introduce M.Phil., programme in Physics to educate the postgraduate students in the fascinating fields. Rigorous and comprehensive in approach, this syllabus presents essential contents in a detailed, clear and direct way

2. LEARNING OUTCOMES:

Upon completion of the programmes, M.Phil. students will be able to

(i) solve theoretical or/and experimental problems of the related research field of studies with the previous accumulated knowledge and problem solving skills,

(ii) communicate clearly and effectively in English, excel in report writing and presentation skill,

(iii) collaborate smoothly with others in team work, demonstrate a sense of responsibility, accountability, leadership and team spirit,

(iv) develop capability of independent thinking, and

(v) . possess a desire for life-long learning and self-learning.

2. ELIGIBILTIY:

Candidates who have qualified for post graduate degree in Physics/ Applied Physics/ Bio Physics/ Material Science / any other equivalent master degree.of ManonmaniamSundaranar University or any other University recognized by the Syndicate as equivalent thereto shall be eligible to register for the Degree of Master of Philosophy (M.Phil.) in Physics.

Candidates who have qualified their post graduate degree in Physics/ Applied Physics/ Bio Physics/ Material Science / any other equivalent master degree.with a minimum of 55 % of marks in their respective postgraduate degree to become eligible to register for the Degree of Master of Philosophy (M.Phil.) in Physics.

For the candidates belonging to SC/ST community and those who have qualified for the Master's degree in Physics/ Applied Physics/ Bio Physics/ Material Science / any other equivalent master degreewith the minimum eligibility marks shall be 50 % in their Master's Degree.

3. DURATION

The duration of M.Phil., course shall extend over a period of one year from the commencement of the course.

4. COURSE OF STUDY

The course of study for M.Phil., degree shall consist of (a) Part-I comprising three written papers according to the Syllabus prescribed from time to time; and (b) Part-II Dissertation.

Part-I shall consist of Paper-I Research Methodology and Paper-II Advanced paper in the main subject. There shall also be a third paper which shall be the background paper relating to the proposed Dissertation.

SADAKATHULLAH APPA COLLEGE (AUTONOMOUS)

RESEARCH DEPARTMENT OF PHYSICS
M.Phil. Physics Syllabus
(Applicable for students admitted in June 2018 and onwards)
COURSE STRUCTURE

I SEMESTER				**II SEMESTER**		
COURSE	**H/W**	**C**		**COURSE**	**H/W**	**C**
Core 1	4	4		Project and Viva - Voce	12	12
Core 2	4	4				
Project Oriented Elective Course (Theory)	4	4				
TOTAL	**12**	**12**		**TOTAL**	**12**	**12**

DISTRIBUTION OF HOURS, CREDITS, NO. OF PAPERS, & MARKS

SUBJECT	**HOURS**	**CREDITS**	**NO. OF PAPERS**	**MARKS**
Core	8	8	2	**200**
Project Oriented Elective Course (Theory)	4	4	1	**100**
Project and Viva-Voce	12	12	1	**100**
TOTAL	**24**	**24**	**4**	**400**

TITLE OF THE PAPERS
M. PHIL. PHYSICS (2018 - 2021)

(The candidate should select any one of the Area Papers in the first semester related to their proposed topics of research)

SEM	**P**	**TITLE OF THE PAPER**	**SUB. CODE**	**H/W**	**C**	**MARKS**		
						I	**E**	**T**
I	DSC1	Research and Teaching Methodology	18MCPH11	4	4	25	75	100
	DSC2	Advanced Physics	18MCPH12	4	4	25	75	100
	DSE	A) Crystal Growth Methods and Characterization Techniques	18MEPH1A	4	4	25	75	100
		B) Nano Physics	18MEPH1B					
		C) Ultrasonic Studies	18MEPH1C					
		D) Nonlinear Dynamics	18MEPH1D					
II	D	Project and Viva-Voce	18MDPH21	-	12	--	100	100
TOTAL				**12**	**24**	**75**	**325**	**400**

unit 1 -2%
unit 2-20%
unit 3-8%
unit 5-20%

I SEMESTER			
DSC 1	**RESEARCH AND TEACHING METHODOLOGY**		**18MCPH11**
Hrs/Week: 4	**Hrs/ Sem: 60**	**Hrs/Unit: 12**	**Credits: 4**

Preamble: To introduce the knowledge on research. This paper provides a broad knowledge on methods of research and teaching, problem solving and analytical techniques

Course Outcomes: Students who completed this course should

- ✓ Have made progress with research leading to a M.Phil thesis.
- ✓ Capable to deliver oral presentation and written report to a very high international standard
- ✓ In-depth analysis & study of the selected research topics
- ✓ refill communication skill – demonstrate the capability in written and spoken (English as a medium) to present and discuss research information within the scientific community and society.
- ✓ Be familiar with the main statistical tests used in Physics.
- ✓ Be familiar with the numerical methods
- ✓ Be familiar with the different methods of teaching

Unit I: Basics of Research

Basics: Meaning, purpose and characteristics of research –. Scientific research : Aim and motivation - Principles and ethic: Identification of research problem - Current status – Literature survey – Abstraction of a research paper – Role of research guide and researcher – Preparation and presentation of scientific reports- Need and methods (Oral and poster) – Writing of synopsis and dissertation.

Unit II: Modern Research Practices in Scientific Research

Usage of open source software and freely licensed software for research work and data analysis – Effective use of internet for research needs-Collaborative work-Interdisciplinary research - scholarly research articles –National, International and Electronic Journals- Online submission of research articles -Open access articles benefits- Impact factor, h-index- Citations- Seminars, workshops, conferences and symposia- Respecting copy rights-Avoiding plagiarism- Intellectual property rights and patents.

Unit III: Methods of Data Analysis

Data-collection – Statistical description of data (mean, median mode, kurtosis , skewness,) – Distributions (Student's t-test, F-test, Chi-square test &Annova), Correlation (linear and nonparametric/rank); Modeling data: Least squares, Fitting data – linear and non-linear models. Pictorial representation of data.

Unit – IV: Numerical Methods

Iterative methods: Newton Raphson iterative method – Secant Method; Interpolation: Newton's forward and backward difference formulae; Differentiation and Integration: Numerical differentiation with interpolation polynomials – Numerical Integration by Trapezoidal and Simpson's rule- Ramberg integration.

Unit – V: Methodology of Teaching:

Teaching – Objectives of Teaching, Phases of Teaching – Teaching Methods: Lecture Method, Discussion Method, Discovery Learning, Inquiry, Problem Solving Method, Project Method, Seminar – Integrating ICT in Teaching: Individualised Instruction, Ways for Effective Presentation with Power Point – Documentation – Evaluation: Formative, Summative & Continuous and Comprehensive Evaluation – Later Adolescent Psychology: Meaning, Physical, Cognitive, Emotional, Social and Moral Development – Teaching Later Adolescents.

Books for Reference

1. Thesis and Assignment Writing – J Anderson, B.H. Dursten and M. Poole, Wiley Eastern (1977).
2. A Hand Book of Methodology of Research – P. Rajammal and P. Devadoss, R.M.M Vidya Press (1976).
3. Research Methodology – S.Rajasekar, P.Philominathan, V. Chinnathambi, RPC Publications, Tirunelveli. (2014)
4. Computer Oriented Numerical Methods – V. Rajaraman, Prentice Hall of India.
5. Numerical Methods for Scientific and Engineering Computation – MK Jain, SRK Iyengar and RK Jain, Wiley Eastern publn.
6. Sampath K, Panneerselvam, A & Santhanam S (1984). Introsuction to educationaltechnology. (2nd revised ed.) New Delhi:Sterling Publishers.
7. Sharma. SR (2003) Effective classroom teaching modern methods, tools & techniques. Jaipur: Mangal Deep
8. Vendanayagam EG (1989). Teaching technology for college teachers. New York: Sterling Publishers

unit 1- 20%
unit 2 - 20%
unit 3 -20%

I SEMESTER			
DSC 2	**ADVANCED PHYSICS**		**18MCPH12**
Hrs/Week: 4	**Hrs/ Sem: 60**	**Hrs/Unit: 12**	**Credits: 4**

Preamble: To introduce knowledge on solar energy sources. To expose the students with knowledge of understanding the basic preparation and to get knowledge about the various properties of solar cells. To impart knowledge onadvanced mathematical methods for research physics. To make the students learn the basics of lasers, nonlinear optics and X-ray diffraction.

Course Outcomes: At the successful completion of this course, the student is expected to have/be able to:

- ✓ List and generally explain the main sources of energy and their primary applications in the world,
- ✓ Describe the challenges and problems for the construction of various types of solar cells,
- ✓ Perform basic calculations relating to crystal planes, lattice parameters and sample characteristics.
- ✓ Understand the basics of X-ray diffraction theory in terms of X-rays, diffraction and Bragg's Law.
- ✓ Provides the students a thorough understanding of the fundamentals of lasers: their unique properties, their operations and their applications.
- ✓ Be familiar with the main mathematical methods used in physics.
- ✓ Understand the fundamentals of the variety of nonlinear optical phenomena
- ✓ Exposed to emerging research topics involving laser light

UNIT I: Solar Energy

Prospects of renewable energy sources – Solar spectrum. Solar cells; Solar cells for direct conversion of solar energy to electric powers- solar cell parameters – solar cell electrical characteristics – Efficiency – Single crystal silicon solar cells- Polycrystalline silicon solar cells- cadmium sulphide solar cells- Applications of solar energy Solar water heating- solar photo voltaic- solar cooking – solar green house.

UNIT II: X-ray diffraction

Introduction - X-rays : sources - conventional generators. X-ray optics: filters – monochromators – collimators – mirrors – safety. Crystals : Lattice planes – Miller indices – Space lattice – X-ray diffraction reciprocal lattice – relation between direct and reciprocal space – Bragg's law in reciprocal lattice.

UNIT III: Lasers

Lasers: Basic principles of Lasers – Nd:YAG Laser – He-Ne laser – Semiconductor diode Laser – Dye Laser – Colour Center Lasers. Applications of Lasers : Medicine, Industry, Communication and Holography.

UNIT IV: Nuclear Models

Introduction to Nuclear models: Liquid drop model- Shell model - Nilsson model - Collective model (Vibration and Rotational contributions) – Standard model.

UNIT V: Characterization Techniques

X-ray diffraction (XRD)- Particle size determination - Fourier Transform Infrared Spectroscopy (FTIR) – UV-Visible Spectroscopy - Differential Thermal Analysis (DTA) - Differential Scanning Calorimeter (DSC) - Vibrating Sample Magnetometer (VSM) – Scanning Electron Microscopy (SEM).

Books for Reference

1. S.P. Sukhatme, Solar Energy, Tata McGraw Hill Edition.
2. G.D. Rai, Non-Conventional Energy sources, Khauna publications, New Delhi.
3. X-ray Structure Determination (2nd Edition) – Stout and Jensen – John Wiley (1989).
4. Fundamentals of Crystallography - (2nd Edition)- C. Giacovazzo- Oxford press.
5. Structure determination of X-ray Crystallography (2nd Edition)- Ladd and Palmer.
6. William Silfvast, Laser Fundamentals , Cambridge University Press, London (1996).
7. B.B. Laud, Lasers and Non Linear optics –New age international P (Ltd) (2^{nd} Edition), New Delhi (1991).
8. AjoyGhatak, Optics -(2nd Edition)- Tata Mcgraw Hill Publications.
9. Mathews and R..L. Walker, Mathematical Methods of Physics (Pearson Education, New Delhi, (2004).
10. P.K.Chattopadhyay, Mathematical Physics, Wiley Eastern Ltd., New Delhi (1990)
11. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Private Limited, 1999.Patterns, Springer Verlag, Berlin (2003).

unit 4 -20%
unit 5 - 5%

I SEMESTER			
DSE A	**CRYSTAL GROWTH METHODS AND CHARACTERIZATION TECHNIQUES**		**18MEPH1A**
Hrs/Week: 4	**Hrs/ Sem: 60**	**Hrs/Unit: 12**	**Credits: 4**

Preamble: To introduce the knowledge on crystal growth and characterization. To expose the students with theories of nucleation & crystal growth, crystal growth from various techniques such as, solution, melt and vapour phase and their characterization.

Course Outcomes:

Students who have completed this course should

- ✓ Understand the formation, classification, theories of nucleation and kinetics of crystal growth
- ✓ Understand the various analysis such as structural and optical and characterization techniques suchsuch as SEM and TG/DGA.,
- ✓ Have an ability to grow the crystals from solutions and melt
- ✓ Be able to know the important applications of crystals

Unit I – Nucleation and kinetics

Saturation and super saturation – solubility– expression for super saturation solution. Nucleation : classifications-Theories of nucleation –Gibbs Thomson equation for solution,Vapour & Melt – Crtitical nucleation parameters- Kinetic of crystal growth.

Unit II - Growth from solutions

Low temperature solution growth: Slow cooling method– slow evaporation method – gel growth process. Temperature gradient Method : high pressure method- electrolyte process.

Unit III - Growth from melt

Bridgeman technique – czocharalski technique – zone melting technique –verneuil process.

Unit IV – Applications of Crystals

Medicine- Cosmetics- Energy- Electronic device fabrications- superconductors- optical devices- Thermal appications.

Unit V - Analysis and Characterizations

Structural analysis : X-ray diffraction Analysis and FTIR spectral analysis. Optical transmission studies (UV) –- Micro hardness studies (vicker)- Scanning Electron Microscope (SEM)- Thermo gravemetric/ diffrencial thermal analysis (TG/DTA).

Books for Reference:

1. Brice J.C, Crystal Growth Processes, John Wiley & sons , New York 1986,
2. Santhanaraghavan P, Ramasamy . P, Crystal Growth – Process and Methods, KRU Publications, Kumbakonam, 2000.
3. Buckly H.E, Crystal Growth, John Wiley & Sons, New York, 1986.
4. Gilman J, The Art of Science of Growing Crystals, John Wiley & Sons, New York, 1956.
5. William Kemp, Oraganic spectroscopy, 3rd Edition, , Palgrave, New York, 2004.

unit 1 -20%
unit 3 - 8%
unit 4 - 7%

I SEMESTER			
DSE B	**NANO PHYSICS**		**18MEPH1B**
Hrs/Week: 4	**Hrs/ Sem: 60**	**Hrs/Unit: 12**	**Credits: 4**

Preamble: To felicitates the knowledge on nanomaterials. To make the students understanding the fundamental aspects of nanomaterials, synthesis, nanostructures, properties and characterization techniques

Course Outcomes: Upon completion of the subject, students will be able to:

- ✓ Demonstrate the understanding of length scales concepts, nanostructures and nanotechnology.
- ✓ Identify the principles of processing, manufacturing and characterization of nanomaterials and nanostructures.
- ✓ Apply the electronic microscopy, scanning probe microscopy and nanoindentation techniques to characterize the nanomaterials and nanostructures.
- ✓ Evaluate and analyze the mechanical properties of nanomaterials

Unit I - Fundamentals of Nanomaterials

Introduction: Nanotechnology and Nanomaterials. Quantum well-quantum wires-quantum dots- Difference between quantum well,quantum wireand quantum dots. Nanorods-and its significance.Carbon nanotubes : Single walled and multiwalledand Applications-Fullerenes and itsapplications.

Unit II - Synthesis of Nanomaterials

Introduction: Top-down and Bottom-up approaches. Physical Techniques: Ball milling- laser ablation-physical vapour deposition (PVD). Chemical Techniques: Sol gel method- co-precipitation method – chemical vapour deposition (CVD).

Unit III – Properties of Nanomaterials

General properties: Physical properties - chemical properties - Optical properties - electrical properties-magnetic properties- mechanical properties - Thermal properties – Antimicrobial activity- Antibacterial properties.

Unit IV – Characterization Techniques

X ray diffraction analysis (XRD) - Fourier Transform Infra Redanalysis(FTIR) - Uv-Visible spectral analysis- Scanning electron microscopy (SEM) - Energy dispersive analysis of x-ray (EDAX).

Unit V - Applications of Nanomaterials

Applications of nanomaterial: Medicine- Food and Textile industry- Cosmetics-Electronic devices-Solar energy- environment- dye- defence & security- optical engineering.

Books for Reference:

1. C.Cao,Nanostructures and Nanomaterials Synthesis, Properties and Applications,Imperial College Press, 2004.
2. Daniel L.Feldheim Colby,A.Foss,Metal Nanoparticles,Synthesis,Characterization and Applications,Wiley VCH ,1998.
3. Dider A, Nanoparticles and Catalysis, Wiley VCH, 2008.
4. G.C.Hdjipanayis,R.W.Seigal, Nanophase Materials,Properties and Applications, Kluwer Academic Publishers 1994.
5. Skoog.D.A,James,Holler.F.Neiman.T.A. Principles and Instrumental Analysis,Harcourt College Press, 2007.

New paper-100%

I SEMESTER			
DSE C	**ULTRASONIC STUDIES**		**18MEMA1C**
Hrs/Week: 4	**Hrs/ Sem: 60**	**Hrs/Unit: 12**	**Credits: 4**

Unit 1 – Measurement of Density, Ultrasonic Velocity and Viscosity for liquid mixtures

Significance of the study of thermo-physical and thermodynamic properties – Densimeter and Antonpar–Preparation of binary mixtures and ternary mixtures - Experimental techniques to determine density of liquid mixtures using Antonpar&Pycnometer – Ultrasonic Interferrometer - Experimental techniques to determine ultrasonic velocity using interferometer.

Unit – 2 Volumetric Properties

Relationship between density and Volumetric properties - Apparent Molal Volume – Partial Molal Volume – Partial MolalExpansivity – Isobaric Thermal Expansion Coefficient – calculation of Hydration Number from volumetric data. Variation of Partial Molal Volume with Temperature – Hepler's constant – Transfer Partial Molal Volume – Pairwise and Triplet interactions by volumetric studies.

Unit- 3 Properties related to Ultrasonic studies

Speed of sound – Relationship between ultrasonic velocity and compressibility properties - Isentropic Compressibility – Change in Isentropic compressibility – Relative change in Isentropic compressibility – Apparent Molal Compressibility – Limiting Apparent Molal Compressibility – Calculation of Hydration number using compressibility data – Transfer Partial Molal Compressibility – Pairwise and Triplet interactions by compressibility studies.

Unit- 4 Viscometric Properties

Relationship between viscosity and viscometric properties - Viscosity - Relative Viscosity – Jones - Dole equation to calculate Viscosity B coefficient – variation of Viscosity B coefficient with temperature –Gibb's Free energy of activation per mole of solute and solvent – Relationship between Free energy of Activation with Viscosity B-coefficient - Transfer B coefficient – Pairwise and Triplet interactions by viscometric studies.

Unit - 5 Analysis of Molecular interactions

Nature of intermolecular interactions between the components of liquid mixtures - Concept of Zwitterions – Polar and Non-Polar groups - Types of interactions - Co-Sphere overlap model –Solute - Solvent interactions – Solute - Solute interactions –Structure making/breaking ability of solute in solvents based on theVolumetric, Ultrasonic and Viscometric properties .

Books For Study And Reference:

1. Fundamentals of Ultrasonics, J. Blitz, Second Edition, Plenum Press, New York,(1967).
2. Thermodynamics of ion hydration in water, Friedman H.L and Krishnan C.V., Plenum Press, New York.
3. Ultrasonics: Fundamentals, Technologies and Applications, Third Edition, Dale Ensminger, Leonard J. Bond, CRC Press, (2011).

New paper-100%

I SEMESTER			
DSE D	**NONLINEAR DYNAMICS**		**18MEMA1D**
Hrs/Week: 4	**Hrs/ Sem: 60**	**Hrs/Unit: 12**	**Credits: 4**

Preamble: To understand the basic concepts of nonlinear dynamics. This course provides knowledge about the effects of nonlinearity on dynamical systems, fractals and its properties and the importance of soliton

Course outcomes: By the end of the course.

- ✓ Students will be able to analyze the behavior of dynamical systems (e.g. find periodic orbits and assess their stability, draw phase portraits, etc.) expressed as either a discrete-time mapping or a continuous-time flow.
- ✓ Students will be able to apply the techniques of nonlinear dynamics to physical processes drawn from a variety of scientific and engineering disciplines.
- ✓ Students will be able to analyze changes (i.e. bifurcations) to dynamical systems as system parameters are varied.
- ✓ Students will be able to independently research topics in nonlinear dynamics and synthesize this work into coherent written and oral presentations.

UNIT – I : **Introduction to Nonlinear dynamics**

The notion of nonlinearity – Superposition principle and its validity – Linear and nonlinear oscillators – Autonomous and nonautonomous systems – Equilibrium points – Phase space – Classification of equilibrium points – Limit cycle motion .

UNIT – IIBifurcation and Chaos in Dissipative Systems

Some simple bifurcations – The logistic map period doubling phenomenon – Onset of chaos – Bifurcation scenario in Duffing oscillator – Route to chaos – Lorenz systems – Sensitive dependence on initial condition – controlling of chaos

UNIT – III Chaos in Conservative Systems

Pointcare cross section – Possible orbits in conservative systems – Henon – Heiles system – Charecterization of regular and chaotic motions : Lyapunov exponents – Numerical computation – Power spectrum and dynamical motion.

Unit – IV: Fractals

Self similarity - Properties and examples of fractals - Fractal dimension - Construction and properties of some fractals-Middle one third cantor set-Koch curve - Sierpinski triangle-Julia set - Mandelbrot set - Applications of fractals.

UNIT – V: Soliton

Linear wave propagation (nondispersive and dispersive) – Fourier transform and solution of intial value problem – wave packet and dispersion – Nonlinear Dispersive system – Scott Russel`s phenomenon –cnoidal waves and Korteweg-de Vries equation – Fermi Pasta Ulam phenomenon-Numerical experiments of Zabusky and Kruskal – birth of solitons.

References:

1. M.Lakshmanan and S.Rajasekar, Nonlinear Dynamics : Intergrability Chaos and Patterns (Springer-Verlag, Berlin, 2003)
2. M.Lakshmanan and K.Murali, Chaos in Nonlinear Oscillators (World Scientific, Singapore, 1996)
3. P.G.Drazin, Nonlinear Systems (Cambridge University Press, Cambridge, 1992)
4. A.J.Lichtenberg and M.A.Lieberman, Regular and Stochastic Motion (Springer- Verlag, Heidelberg, 1992).
5. P.G.Drazin and R.S.Johnson, Solitons : An Introduction (Cambridge University Press, Cambridge, 1989).
6. M.J.Ablowitz and P.A.Clarkson, Solitons : Nonlinear Evolution Equations and Inverse Scattering (Cambridge University Press, Cambridge, 1991)

II SEMESTER		
D	**DISSERTATION**	**18MDPH21**
Hrs/Week: 12	**Hrs/ Sem : 180**	**Credits: 12**

The following guidelines have to be followed by every candidate while preparing his/her M.Phil. Dissertation:

1 The Dissertation should be typed in English.

2 The first page, declaration and certificate of the dissertation should be according to the model given at the end of this.

3 Dissertation text should be typed in MS Word / LaTeX with size 12 / 13 on A4 size Executive bond quality paper with double line spacing. Each page should contain at least 20 lines.

4The number of pages in M. Phil. Dissertation should be not less than 80 pages inclusive of bibliography and Annexure.

5Candidates shall submit the dissertation to the Controller of Examinations through the Supervisor and Head of the Department within 6 months but not earlier than 5 months from the date of start of the second semester.

6.Two bound copies of the M.Phil. Dissertation duly signed by the Guide and Head of the Department should be submitted through the Controller of Examinations along with the CD containing the softcopy of the Dissertation in PDF format.

7.The M.Phil. scholars should attend at least one of the following:

training programmes / Workshops / Seminars / Symposiums, etc., and that they should also have a paper either published or received for acceptance in an ISSN / Reputed Journal before submitting the Dissertation. M.Phil. Scholars shall present at least one research paper in a conference or seminar as per UGC norms. Photo copy of the publication/Letter of acceptance for publication should be given as Annexure at the end of the Dissertation. **Scholars who fail to comply with the above are not eligible for the submission of their Dissertation.**

8. Both the Internal as well as External Examiner award 100 marks for the Dissertation. The distribution of mark will be 60 marks for the Dissertation and 40 marks for the Public Viva-voce Examination. In the Public Viva-voce Examination, the M. Phil. Scholars should present their dissertation work with PowerPoint Presentation. The division of marks for the Dissertation is as mentioned below.

9. The medium of instruction in M.Phil courses is English and students shall write the CIA and Semester Examinations in English.

(Model for the Title Page of the Dissertation)

TITLE OF THE DISSERTATION

Dissertation Submitted to the
SadakathullahAppa College (Autonomous)
in partial fulfilment of the requirements for the award of the degree of

MASTER OF PHILOSOPHY (MAJOR)

Submitted by

NAME OF THE CANDIDATE

(REGISTER NO. XXXXXXXX)

Under the guidance of

NAME OF THE GUIDE

Designation of the Guide
SadakathullahAppa College (Autonomous)
Tirunelveli – 627011

RESEARCH DEPARTMENT OF (MAJOR)
SADAKATHULLAH APPA COLLEGE (AUTONOMOUS)
TIRUNELVELI – 627011
MONTH, YEAR

(Model for the Certificate of the Dissertation)

SadakathullahAppa College (Autonomous)

Rahmath Nagar,Tirunelveli – 627011

CERTIFICATE

Certified that the dissertation work with the title, **"TITLE OF THE DISSERTATION"**submitted by **NAME OF THE CANDIDATE** with the register number XXXXXXX in partial fulfilment of the requirements for the award of the degree of **Master of Philosophy in (Major) at the Research Department of (Major),SadakathullahAppa College (Autonomous),** is a work done by the candidate during the period 20XX-XX, under my guidance and supervision and this dissertation or any part thereof has not been submitted elsewhere for any other Degree or Diploma.

Tirunelveli – 627011
DD-MM-YEAR

<<Signature of the HOD with date>>
<<Name of the HOD>>
<<Academic Designation of the HOD>>
<<Name of the Department>>
SadakathullahAppa College (Autonomous)
Tirunelveli - 11

<<Signature of the Supervisor with date>>
<<Name of the Supervisor>>
<<Academic Designation of the Supervisor>>
<<Name of the Department>>
SadakathullahAppa College (Autonomous)
Tirunelveli - 11

Viva-Voce Examination for the candidate was conducted on ……..……

Internal Examiner External Examiner

(Model for the Declaration by the Candidate)

Name of the Candidate,

M.Phil. Scholar, (Register No.: XXXXXXX)
Research Department of XXXXXXXX,
SadakathullahAppa College (Autonomous),
Rahmath Nagar, Tirunelveli – 627011

DECLARATION BY THE CANDIDATE

I hereby declare that, the dissertation with the title, **"TITLE OF THE DISSERTATION"**submitted in partial fulfilment of the requirements for the award of the degree of **Master of Philosophy in XXXXXXXX** at **the Research Department of XXXXXXXX, SadakathullahAppa College (Autonomous)**, is my original work done under the guidance of **Name of the Guide, Designation of the Guide, SadakathullahAppa College (Autonomous), Tirunelveli – 11** and this work has not been submitted elsewhere for any other Degree or Diploma.

Tirunelveli – 627011
DD-MM-YEAR **(Signature of the Candidate)**

Countersigned

1.Signature and Seal of the Guide **2. Signature and Seal of the HOD**