Sadakathullah Appa College

(Autonomous)

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

Rahmath Nagar, Tirunelveli – 627 011, Tamil Nadu.

PG DEPARTMENT OF PHYSICS

CBCS SYLLABUS

For

M.Sc. Physics

(Applicable for students admitted in June 2019 and onwards)
(As per the Resolutions of the Academic Council Meetings held on 03-03-2018, 17-10-2018 and 02-03-2019).

CONTENTS

SADAKATHULLAH APPA COLLEGE(AUTONOMOUS)
(REACCREDITED BY NAAC WITH 'A' GRADE AND ISO 9001:2015CERTIFIED INSTITUTION)
RAHMATH NAGAR, TIRUNELVELI – 627 011.
DEPARTMENT OF PHYSICS
SYLLABUS (CBCS)
M.Sc. (PHYSICS)
For those who join the course from 2019 – 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.

POST GRADUATE DEPARTMENT OF PHYSICS
CBCS SYLLABUS M.Sc. PHYSICS (2018 - 2021)
COURSE STRUCTURE (CBCS)
(Applicable for students admitted in June 2019 and onwards)

I SEMESTER				**II SEMESTER**		
COURSE	**H/W**	**C**		**COURSE**	**H/W**	**C**
DSC 1	6	4		DSC 4	5	4
DSC 2	6	4		DSC 5	5	4
DSC 3	6	4		DSC 6	5	4
DSE 1	4	4		DSE 2	4	4
P-I	4	2		P-III	4	2
P-II	4	2		P-IV	4	2
				IDC-I	3	3
TOTAL	**30**	**20**		**TOTAL**	**30**	**23**
III SEMESTER				**IV SEMESTER**		
DSC 7	5	4		DSC 10	5	4
DSC 8	5	4		DSC 11	5	4
DSC 9	5	4		DSC 12- Project	8	8
DSE 3	4	4		DSE 4	4	4
P-V	4	2		P-VII	4	2
P-VI	4	2				
				P-VIII	4	2
IDC 2	3	3				
TOTAL	**30**	**23**		**TOTAL**	**30**	**24**
I – IV SEMESTER						
MOOC*		2#				

DISTRIBUTION OF HOURS, CREDITS, NO. OF PAPERS, & MARKS				
SUBJECT	**HOURS**	**CREDITS**	**NO. OF PAPERS**	**MARKS**
DSC THEORY + PROJECT	66	52	12	1200
DSC PRACTICALS	32	16	8	400
DSE	16	16	4	400
IDC	6	6	2	200
MOOC*		2#	1	
TOTAL	**120**	**90+2#**	**27**	**2200**

COURSE STRUCTURE
POST GRADUATE DEPARTMENT OF PHYSICS
CBCS Syllabus – M.Sc., Physics (2019-2020 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	General Physics Practicals– I	18PCPH1P1	4	2	40	60	100/2
	P-II	Advanced Electronics Practicals -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	General Physics Practicals – II	18PCPH2P1	4	2	40	60	100/2
	P – IV	Advanced Electronics Practicals -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	Advanced Physics Practicals – I	18PCPH3P1	4	2	40	60	100/2
	P-VI	Microprocessor Practicals	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	Advanced Physics Practicals - II	18PCPH4P1	4	2	40	60	100/2
	P- VIII	Numerical methods and C++ Programming Practicals	18PCPH4P2	4	2	40	60	100/2
I-IV		Massive Open Online Course *		-	2#			
			Total	**120**	**90+2#**			**2200**

* As per the guidelines of the UGC all the UG and the PG students shall enrol for one Massive Open Online Course offered through SWAYAM, NPTEL, etc.
# Two extra credits will be given on completion of the course.

I SEMESTER			
DSC1	**MATHEMATICAL PHYSICS – I**		**18PCPH11**
Hrs/Week : 6	**Hrs/Sem : 90**	**Hrs/Unit: 18**	**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 curvilinear 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).

I SEMESTER			
DSC 2	**CLASSICAL MECHANICS**		**18PCPH12**
Hrs/Week : 6	**Hrs/Sem : 90**	**Hrs/Unit: 18**	**Credits : 4**

Preample: Classical mechanics is one of thebackbone 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 form 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 IVHAMILTONIAN 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.

I SEMESTER			
DSC3	**MOLECULAR AND RESONANCE SPECTROSCOPY**		**18PCPH13**
Hrs/Week : 6	**Hrs/Sem : 90**	**Hrs/Unit: 18**	**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 radiation interacts 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 C_{2V} and C_{3V} point groups – Representation of Molecular Vibrations in Symmetry co-ordinates – Normal coordinate analysis for H_2O 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 effect.

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. Banwelland ; 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. G.R 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).

I SEMESTER			
DSE – 1A	**INTEGRATED ELECTRONICS**		**18PEPH1A**
Hrs/Week : 4	**Hrs/Sem : 60**	**Hrs/Unit: 12**	**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 transistors, 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 memory –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).

I SEMESTER			
DSE – 1B	**NANO SCIENCE**		**18PEPH1B**
Hrs/Week : 4	**Hrs/Sem : 60**	**Hrs/Unit: 12**	**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.

I SEMESTER		
P- I	**GENERAL PHYSICS PRACTICALS - 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.

I SEMESTER		
P- II	**ADVANCED ELECTRONICS PRACTICALS-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.

II SEMESTER			
DSC4	**MATHEMATICAL PHYSICS – II**		**18PCPH21**
Hrs/Week : 5	**Hrs/Sem : 75**	**Hrs/Unit: 15**	**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			
DSC 5	**QUANTUM MECHANICS - I**		**18PCPH22**
Hrs/Week : 5	**Hrs/Sem : 75**	**Hrs/Unit: 15**	**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. Sathya Prakash ,Advanced Quantum Mechanics- Kedar Nath Ram Nath Publication, New Delhi, (2009).

II SEMESTER			
DSC 6	**STATISTICAL MECHANICS**		**18PCPH23**
Hrs/Week : 5	**Hrs/Sem : 75**	**Hrs/Unit: 15**	**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, Kedarnath 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

II SEMESTER			
DSE-2A	**MICROPROCESSOR AND MICROCONTROLLERS**		**18PEPH2A**
Hrs/Week : 4	**Hrs/Sem : 60**	**Hrs/Unit: 12**	**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. B. Ram, Fundamentals of Microprocessors and microcontrollers –Dhanpat Rai publications , 2005, New Delhi.
3. A.NagoorKani, Microprocessors and microcontrollers–Tata McGraw-Hill Education Pvt. Ltd., 2nd Edition, 2012, New Delhi.

BOOKS FOR REFERENCE:

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

II SEMESTER			
DSE-2B	**NUMERICAL METHODS AND PROGRAMMING**		**18PEPH2B**
Hrs/Week : 4	**Hrs/Sem : 60**	**Hrs/Unit: 12**	**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. M.K.Venketaraman, Numerical Methods in Science and Engineering, 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. Kernigham& Richie, The C programming language, PHI Publication New Delhi-2007, 2nd Edition.
3. V. Chinnathambi and U. Sankar, C++ for Physicists, Nanolight Publications, Palayamkottai, 2007.

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

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.

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

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

III SEMESTER			
DSC 7	**QUANTUM MECHANICS II**		**18PCPH31**
Hrs/Week : 5	**Hrs/Sem : 75**	**Hrs/Unit: 15**	**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, Wiley Publications, 1999.

III SEMESTER			
DSC 8	**ELECTROMAGNETIC THEORY**		**18PCPH32**
Hrs/Week : 5	**Hrs/Sem : 75**	**Hrs/Unit: 15**	**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 Wave guides, 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.

III SEMESTER			
DSC 9	**NUCLEAR AND PARTICLE PHYSICS**		**18PCPH33**
Hrs/Week : 5	**Hrs/Sem : 75**	**Hrs/Unit: 15**	**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).

III SEMESTER			
DSE-3A	**NONLINEAR DYNAMICS**		**18PEPH3A**
Hrs/Week : 4	**Hrs/Sem : 60**	**Hrs/Unit: 12**	**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 Hamiltonian 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. H.G.Schuster, Deterministic Chaos, Verlag,Weinheim,1998.
3. A.J. Lichtenberg and M.A. Lieberman : Regular and Stochastic Motion, Verlag, Weinhreim,1998.

BOOKS FOR REFERENCE:

1. M.Lakshmanan and K.Murali, Chaos in nonlinear oscillator, controlling and synchronization, 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.

III SEMESTER			
DSE-3B	**CRYSTAL GROWTH AND THIN FILMS**		**18PEPH3B**
Hrs/Week : 4	**Hrs/Sem : 60**	**Hrs/Unit: 12**	**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., ‘Crystal Growth Process’, John Wiley and Sons, New York, 1986.
2. R.A. Stradling &P.C.Klipstein, Growth and Charaterization of Semiconductors, Adam Hilser, Bristol, 1990.
3. Buckley H.E., 'Crystal Growth', John Wiley and Sons, New York, 1951.
4. Pamplin B.R., ‘Crystal Growth’, Pergman Press, London, 1980.

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

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

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

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.

IV SEMESTER			
DSC10	**SOLID STATE PHYSICS**		**18PCPH41**
Hrs/Week : 5	**Hrs/Sem : 75**	**Hrs/Unit: 15**	**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 – Kronigpenney 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. Charles Kittel, Introduction to Solid State Physics, 7 Edition, John Wiley & Sons, New York, 1996. (Chapters: 2,4,5,6,7,9,,14,15,18,19,20)
2. S.O.Pillai, Solid State Physics, Revised 6 thEdition,New Age International Publishers New Delhi, 2007

BOOKS FOR REFERENCE:

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

IV SEMESTER			
DSC11	**RESEARCH METHODOLOGY**		**18PCPH42**
Hrs/Week : 5	**Hrs/Sem : 75**	**Hrs/Unit: 15**	**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. C. R. Kothari, Research Methodology: Methods and Techniques, New Age International Publishers, ISBN:81-224-1522-9,New Delhi.
2. P.Philominathan and V. Chinnathambi, Research Methodology by S.Rajasekar, 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.
4. 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

IV SEMESTER			
DSE-4A	**OPTOELECTRONICS AND LASERS**		**18PEPH4A**
Hrs/Week : 4	**Hrs/Sem : 60**	**Hrs/Unit: 12**	**Credits :4**

Preamble: Lasers and Optoelectronics 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. J. Wilson and J.F.B. Hawkes, Optoelectronics, Prentice Hall Publication, New Delhi, 1995.
3. S.Nagabhushana, N.Sathyanarayana, Laser & Optical Instrumentation, 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.

IV SEMESTER			
DSE-4B	**MATERIALS SCIENCE**		**18PEPH4B**
Hrs/Week : 4	**Hrs/Sem : 60**	**Hrs/Unit: 12**	**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. V.Raghavan, Materials Science and Engineering-A First Course, Fifth Edition Prentice Hall of India, New Delhi,2011

2. William F Smith, JavadHashemi, Materials Science and Engineering in SI units, Tata McGrawHill 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. O.P. Khanna, A text book of Material Science and metallurgy, Dhanpat Rai Publications 2013

2. M.Arumugam, Materials Science, Anuradha Publications, Kumbakonam,2002.

IV SEMESTER		
P-VII	**ADVANCED PHYSICS PRACTICALS - 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

IV SEMESTER		
P-VIII	**NUMERICAL METHODS AND C++ PROGRAMMING PRACTICALS**	**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) Using Runge kutta method.
4. Solution of radioactive decay problem (or any physics problem) Using Euler's method.
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 numerical 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 roots of the quadratic equation

IDC SUBJECTS OFFERED BY DEPARTMENT OF PHYSICS TO OTHER MAJOR STUDENTS

II SEMESTER			
IDC-1	**RENEWABLE ENERGY**		**18PIPH21**
Hrs/Week : 3	**Hrs/Sem :45**	**Hrs/Unit: 9**	**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:

1. Non-Conventional Energy Sources by G.D.Rai, KhanaPubliation, New Delhi (1988).
2. 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.
2. Solar energies of Thermal processes by A.Duffie and W.A.Becjmann, John-wily (1980).
3. Principle of Solar engineering by F.Krith and J.F.K. Krcider, McGraw-Hill (1978).

III SEMESTER			
IDC-2	**DIGITAL ELECTRONICS**		**18PIPH31**
Hrs/Week : 3	**Hrs/Sem : 45**	**Hrs/Unit: 9**	**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 4 variables) – POS – K-map simplification using max terms (2, 3 and 4 variables) – 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-2R binary 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).