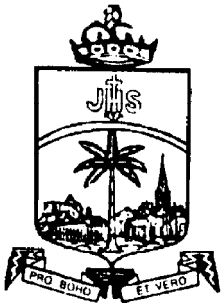
M.Sc. PHYSICS

SYLLABUS: 2010-2012

CHOICE BASED CREDIT SYSTEM
(CBCS)



St. JOSEPH'S COLLEGE (Autonomous)

Re-accredited with A⁺ Grade by NAAC

College with Potential for Excellence by UGC

TIRUCHIRAPPALLI - 620 002, INDIA

FEATURES OF CHOICE BASED CREDIT SYSTEM

PG COURSES

The Autonomous (1978) St. Joseph's College, Reaccredited with A+ Grade from NAAC (2006), had introduced the Choice Based Credit System (CBCS) for PG courses from the academic year 2001 – 2002. As per the guidelines of Tamil Nadu State Council of Higher Education (TANSCHE) and the Bharathidasan University, the College has reformulated the CBCS in 2008 – 2009 by incorporating the uniqueness and integrity of the college.

OBJECTIVES OF THE CREDIT SYSTEM

- To provide mobility and flexibility for students within and outside the parent department as well as to migrate between institutions
- To provide broad-based education
- To help students learn at their own pace
- To provide students scope for acquiring extra credits
- To impart more job oriented skills to students
- To make any course multi-disciplinary in approach

What is credit system?

Weightage to a course is given in relation to the hours assigned for the course. Generally one hour per week has one credit. For viability and conformity to the guidelines credits are awarded irrespective of the teaching hours. The following Table shows the relation between credits and hours.

Sem.	Specification	No. of Papers	Hour	Credit	Total Credits
I – IV	Core Courses (Theory & Practical)	14	6	14 x 5	70
	Project	1	--	1 x 5	Additional
I – IV	3 – Core Electives	3	4	3 x 4	12
	2 – Inter Dept. Courses (IDC)	2	4	2 x 4	08
I – IV	SHEPHERD – Extension Activity	~	70	5	Additional

Total Minimum Credits	90
Total Additional Credits (Compulsory)	10
Other Additional Credits (Dept. Specific)	....

However, there could be some flexibility because of practical, field visits, tutorials and nature of project work.

For PG courses a student must earn a minimum of 90 credits and 10 compulsory credits as mentioned in the above table. The total number of courses offered by a department is 20. However within their working hours a few departments can offer extra credit courses.

Course Pattern

The Post Graduate degree course consists of three major components. They are Core Course, Elective Course and Inter Department Course (IDC) . Also 2 compulsory components namely Project / Project related items and Shepherd, the extension components are mandatory.

Core Course

A core course is the course offered by the parent department, totally related to the major subject, components like Practical, Projects, Group Discussion, Viva, Field Visit, Library record form part of the core course.

Elective Course

The course is also offered by the parent department. The objective is to provide choice and flexibility within the department. The student can choose his/her elective paper. Elective is related to the major subject. The difference between core course and elective course is that there is choice for the student. The department is at liberty to offer three elective courses any semester. It must be offered at least in two different semesters. The Staff too may experiment with diverse courses.

Inter Department Course (IDC)

IDC is an inter departmental course offered by a department for the students belonging to other departments. The objective is to provide mobility and flexibility outside the parent department. This is introduced to make every course multi-disciplinary in nature. It is to be chosen from a list of courses offered by various departments. The list is given at the end of the syllabus copies. Two IDC s must be taken by students which are offered in Semester II & III.

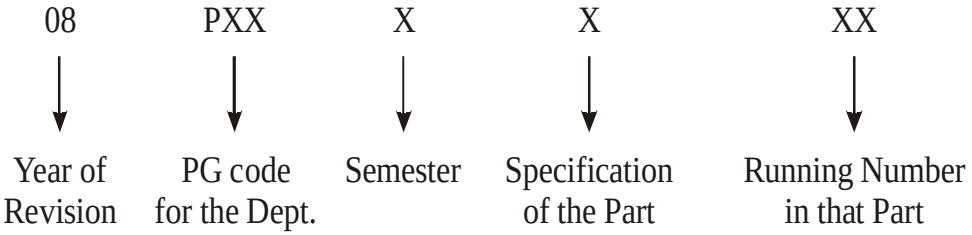
Day College (Shift-I) student may also take an IDC from SFS (Shift-II) course and vice versa

This provision enables students to earn extra credits. For the Shift – I students it is offered in their last hour and for the Shift-II

(Course) students in their first hour. The IDC are of application oriented and inter-disciplinary in nature.

Subject Code Fixation

The following code system (9 characters) is adopted for Post Graduate courses:



01 – Core Courses: Theory & Practical
02 – Core electives
03 – Additional Core Papers (if any)
04 – Inter Departmental Courses
05 – Project (compulsory)
06 – Shepherd (compulsory

CIA Components

The CIA Components would comprise of two parts: (1) Test Components conducted by Controller of Examination (COE) and (2) Teacher specific component. The two centralized tests will be conducted by the COE (Mid-Semester Test & End-Semester Test) for 30% each administered for 1 hour and 30 minutes duration. The remaining 40% would comprise of any four components as listed below and will be carried out by the faculty concerned for that paper.

- Assignment, Quiz (Written / Objective), Snap test, Viva-Voce, Seminar, Listening Comprehension, Reading Comprehension, Problem Solving, Map Reading, Group Discussion, Panel Discussion, Field Visit, Creative Writing, Open Book Test, Library Record, Case Study.
- As a special consideration, students who publish papers in referred journals would be exempted from one of the teacher specific internal components in one of the papers. At the beginning of each semester, the four internal components would be informed to the students and the staff will administer those components on the date specified and the marks acquired for the same will be forwarded to the Office of COE.

Question Pattern

Pattern	Mid & End Semester Test	Semester Exam
Part A : Objective	6 x 0.5 = 03	20 x 1 = 20
Short Answer	2 x 1 = 02	
Part B : Either/or type	3 x 3 = 09	5 x 6 = 30
Part C : Comprehensive	(2/3) 2 x 8 = 16	(4/5) 4 x 12.5 = 50
	Total = 30	Total = 100

Evaluation

For each course there are formative continuous internal assessment (CIA) and semester examinations (SE) in the weightage ratio 50:50. Once the marks of CIA and SE for each course are available, the Overall Percentage Mark (OPM) for a student in the programme will be calculated as shown below:

$$OPM = \frac{\sum_i C_i M_i}{\sum_i C_i}$$ where Ci is the credit earned for that course in any semester and Mi is the marks obtained in that course.

The Scheme of Over-all Results is as follows:

	PG	
Class	Arts (OPM)	Science (OPM)
SECOND	50 to 59.99	50 to 59.99
FIRST	60 to 74.99	60 to 79.99
DISTINCTION	75 & Above	80 & Above

The performance in Compulsory credits in Project and Project related items and in Shepherd programme is indicated by a pass and is not taken into account for computing OPM.

Declaration of Result

Mr. /Ms. _____ has successfully completed M.Sc. / M.A. degree course in _____. The student's overall average percentage of marks is _____ and has completed the minimum 90 credits. The student has acquired 10 more compulsory credits from Project and Shepherd courses. The student has also acquired _____ (if any) extra credits from courses offered by the parent department.

COURSE DETAIL

Sem	Code	Title of the paper	Hrs	Cr	
1	10 PPH 1101	Classical Mechanics	6	5	Core 1
	10 PPH 1102	Mathematical Physics	6	5	Core 2
	10 PPH 1103	Analog and Digital Electronics	6	5	Core 3
	10 PPH 1104	Physics Practical – I	8	5	Core 4
	10 PPH 1201A	Elective-I :Numerical and Computational Physics (or)			
	10 PPH 1201B	Elective-I : Experimental Techniques of Instrumentation	4	4	Core opt 1
		Total for Semester I	30	24	
2	10 PPH 2105	Quantum Mechanics	6	5	Core 5
	10 PPH 2106	Electrodynamics and Plasma Physics	6	5	Core 6
	10 PPH 2107	Microprocessor and Microcontroller	6	5	Core7
	10 PPH 2108	Physics Practical – II	8	5	Core 8
	10 PPH 2401	INTER DEPARTMENTAL COURSE - Modern Photography	4	4	Inter-dept
		Total for Semester II	30	24	
3	10 PPH 3109	Statistical Mechanics	6	5	Core 9
	10 PPH 3110	Atomic and Molecular Spectroscopy	6	5	Core 10
	10 PPH 3111	Physics Practical – III	8	5	Core 11
	10 PPH 3202A	Elective-II: Communication Physics (or)			
	10 PPH 3202B	Elective-II :Advanced Quantum Mechanics	4	4	Core opt 2
	10 PPH 3402	INTER DEPARTMENTAL COURSE - Medical Physics	4	4	Inter-dept
		Project Literature Survey	2	-	
		Total for Semester III	30	23	
4	10 PPH 4112	Nuclear , Particle and Astrophysics	6	5	Core 12
	10 PPH 4113	Condensed Matter Physics	6	5	Core 13
	10 PPH 4114	Physics Practical – IV	8	5	Core 14
	10 PPH 4501	Project & *viva - voce*	6	5	project
	10 PPH 4203A	Elective-III: Advanced Condensed Matter Physics (or)			
	10 PPH 4203B	Elective-III : Nano science and Nano technology	4	4	Core opt 3
		Total for Semester IV	30	24	
1-4	10 PCC 4601	Extension Service: SHEPHERD		5	SHEP
		Total for all semesters	120	100	

Semester – I Hours / Week : 6
10 PPH 1101 Credit : 5

CLASSICAL MECHANICS

Objectives:

- *To understand the fundamental principles of classical mechanics and their applications*

UNIT – I : FUNDAMENTAL PRINCIPLES AND LAGRANGIAN FORMULATION (15 Hrs)

Mechanics of a particle and system of particles – conservation laws – constraints – Generalised coordinates – D' Alembert's principle and Lagrange's equation – Hamilton's principle – Lagrange's equation of motion from Hamilton's principle – conservation theorems and symmetry properties.

UNIT – II : TWO-BODY CENTRAL FORCE PROBLEMS (15 Hrs)

Equations of motion and first integrals – The equivalent one – dimensional problem and classification of orbits – The Keplar problem – Inverse square law of force, the Laplace Runge-Lanz Vector – Scattering in a central force field – Scattering in laboratory and centre of mass frames.

UNIT – III : HAMILTON'S FORMULATION (15 Hrs)

Cyclic coordinates — Hamilton's canonical equations of motion – Hamilton's equations from variational principle – Principle of least action – Application – canonical transformations – Infinitesimal constant transformations – Lagrange and Poisson brackets – Hamilton – Jacobi method – Action angle variables – Kepler problem in action – angle variables.

UNIT – IV : RIGID BODY DYNAMICS AND OSCILLATORY MOTION (15 Hrs)

Euler angles – Moments and Products of Inertia – Euler's equations – symmetrical top – applications – theory of small

oscillations and normal modes – frequencies of free vibration and normal coordinates – Linear triatomic molecule.

UNIT – V : RELATIVISTIC MECHANICS (15 Hrs)

Algebra of tensors – quotient law – fundamental tensor – cartesian tensors – four vectors in special theory of relativity – Lorentz transformations in real four dimensional spaces, Covariant four dimensional formulations – force and energy equations in relativistic mechanics – Lagrangian and Hamiltonian formulation of relativistic mechanics.

BOOKS FOR STUDY

1. Herbert Goldstein : Classical Mechanics, (2nd edn) (New Delhi: Narosa Publishing House, 1996)
2. Matrices & Tensors in Physics by AW Joshi – Weiley Eastern,

UNIT	BOOK	SECTIONS
I	1	1.1 – 1.4, 1.6, 2.1, 2.3, 2.4, 2.6
II	1	8.1, 8.5, 8.6, 9.1, 9.2, 9.4, 9.5, 10.1-10.5, 10.6
III	1	4.4, 5.1, 5.5-5.7, 6.1-6.4
IV	1	1.1, 1.3, 2.1, 2.7, 2.10.1, 2.10.3, 2.11, 2.12
V	2	5.2, 6.2, 6.3, 6.9, 9.2, 10.0-10.4

BOOK FOR REFERENCE

1. Rana, N.C. and Joag, P.S.: Classical Mechanics, (New Delhi: Tata McGraw Hill, 1998) (Units I, II & III)

Semester – I Hours / Week : 6
10 PPH 1102 Credit : 5

MATHEMATICAL PHYSICS

Objectives

- *To understand various mathematical techniques and concepts*
- *To apply these techniques to solve Physics problems*

UNIT – I : LINEAR VECTOR SPACES AND MATRIX THEORY (15 Hrs)

Vector spaces: Linear independence of vectors – vector space of n-tuplets – inner product space – Schmitt's orthoganalisation method – Schwartz inequality – linear transformations.

Matrix theory : Review of basic concepts – bilinear and quadratic forms – functions of matrix – Kronecker sum and product of matrices – Dirac and Pauli matrices.

UNIT II : GROUP THEORY (15 Hrs)

Definition and nomenclature – Rearrangement theorem – cyclic groups – subgroups and cosets – conjugate elements and class structure – identification of symmetry element and operations – molecular point groups – matrix representation of symmetry operations – The Great Orthogonality Theorem – (qualitative treatment) – character of representation – character table – generating symmetry operators – construction of character tables – irreducible representation for C_{2v} and C_{3v} groups – symmetry species specifications, SU(2) & SO(3) groups in elementary particles.

UNIT III : SPECIAL FUNCTIONS (15 Hrs)

Gamma and Beta functions – properties and their basic relations. DE and series solution of Legendre and Hermite – their polynomial, Rodrique's formula, generating function – recurrent relation – orthogonality relations.

UNIT IV : TRANSFORMS (15 Hrs)

Fourier series: Dirichlets condition – determination of coefficient – function having arbitrary period – half range expansion

– some typical waveforms — Application of FS in forced vibrations.

Fourier Transform: FT of a time dependent function – some important theorems: Parseval's, linearity, derivatives, shifting of origin and convolution use of FT in solving PDE for heat conduction.

Laplace transforms: Some standard functions – shifting and convolution theorem – derivative of a function - Application to solving linear ODE.

UNIT V : COMPLEX ANALYSIS (15 Hrs)

Cauchy—Riemann conditions — Cauchy's Ist integral theorem – applications to multiply connected region –Cauchy's IInd integral theorem – derivatives of analytic Complex function –– Singular points and their classification — Laurent series — Cauchy's residue theorem – calculation of residue at a point – evaluation of definite integrals around the unit circle, around a semicircular contour, along the rectangular contour, integral of the form $\int_{-\infty}^{\infty} F(x)\,dx$ – Jordan's Lemma

Books for study:

1. Joshi AW – Matrices and Tensors in Physics – Wiley Eastern Ltd. 1995
2. Trnkhan M – Group Theory and Quantum Mechanics – McGraw Hill – New Delhi. 1964
3. Aruldhas G – Molecular Structure and Spectroscopy – Prentice Hall of India.
4. Bell W & Van Dale – Special Functions for Engineers and Scientists – Nostrand company Ltd. 1969
5. Mathematical Methods for Engineers and Physicists – A.K Mukhopadhyay, Wheeler Publications – New Delhi. 1998

UNIT	BOOK	SECTIONS
I	1	Ch. I,XI,XII,XIII & XIV
II	2	Ch. 1, Ch2 : 1-4 Ch.3: 1-4
II	3	Ch 5: 5.1 – 5.13
III	4	Ch. I.1, II .2, II .4, III 1.7, IV 1,2,3,4, V 1,2,6
IV	5	Ch. 7,13 7.1 – 7.10, 13.1 – 13.14
V	5	Ch. 14.3 – 14.5

Semester – I Hours / Week : 6
10 PPH 1103 Credit : 5

ANALOG AND DIGITAL ELECTRONICS

Objectives:

- *To understand various techniques and concepts in Electronics*
- *To apply these techniques in practical circuits.*
- *To develop the skill in handling instruments.*

Unit I : ELECTRONIC DEVICES (15 Hrs)

SCR- Characteristics – parameters – control circuits using SCR, TRIAC and DIAC, UJT- characteristics –parameters – Relaxation oscillator – UJT control of SCR, LED, LCD, voltage variable capacitors diodes.

Unit II : OP-AMP APPLICATIONS AND VOLTAGE REGULATION (15 Hrs)

741 op-amp, Instrumentation amplifier, V to I and I to V converter, sample and hold circuit, comparator, square wave generator, sine wave generators - Series op-amp regulator, IC voltage regulators, 723 general purpose Regulator, Switching Regulator.

Unit III : DAC, ADC AND TIMER IC (15 Hrs)

Basic DAC Techniques – Weighted Resistor DAC – R-2R ladder DAC – A/D converters – Parallel comparator ADC – The counter type ADC – Successive approximation converter – Dual slope ADC - 555 Timer – Description of functional diagram – Monostable operation – applications in Monostable mode – Astable operation – applications in Astable mode.

Unit IV: COMBINATIONAL LOGIC DESIGN (15 Hrs)

Simplification of logical functions using K map, EX-OR and EX-NOR simplification of K maps, Quine-McCluskey minimization technique, Combinational logic design using MSI circuits-

Multiplexers- Demultiplexers /Decoders, BCD Arithmetic, ALU, Digital comparators, Parity generators/checkers, Code converters, Priority encoders, Decoder/drivers for display devices.

Unit V: SEQUENTIAL LOGIC DESIGN, SEMICONDUCTOR MEMORIES AND DIGITAL EQUIPMENTS (15 Hrs)

Registers, Applications of shift registers, Asynchronous counters, Synchronous counters, Synchronous counter design, Clocked sequential circuit design, Memory organization and operation, Expanding memory size, Classification and characteristics of memories, ROM, RAM, Charge Coupled Devices.. Digital building blocks, Digital voltmeters, Frequency counter, period counter, Digital clock, Digital audio.

Books for Study

1. David A. Bell, Electronic devices and circuits, 3rd edn, Prentice Hall of India, New Delhi 1999.
2. Roy Choudhury, D and Shall Jain, Linear Integrated Circuits, Wiley Eastern Ltd., New Delhi, 2005
3. R. P. Jain, Modern Digital Electronics, 3rd edn, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2003.
4. Virendrakumar, Digital Technology, New Age International Pvt. Ltd., New Delhi, 1995.

Unit	Book	Sections
I	1	18.1 – 18.4,18.6 – 18.10, 19.5, 19.9, 20.3
II	2	2.5.2,4.3,4.5,4.7,5.2,5.4,5.7,6.2-6.5
III	2	10.2, 10.2.1, 10.2.2, 10.2.5, 10.3, 10.3.1, 10.3.2, 10.3.4, 10.3.6, 10.4, 8.1- 8.3. 8.3.1, 8.4, 8.4.1, 8.5
IV	3	5.3-5.9, 5.11, 6.1-6.3, 6.4, 6.4.2,6.5 -6.11
V	3 4	8.1-8.4, 8.5.1, 8.6, 11.2-11.4, 11.6, 11.7, 11.9 Chapter 16

Semester – 1 Hours/Week: 8
10 PPH 1104 Credits : 5

M.Sc - PHYSICS PRACTICAL - I

Any 15 of the following:

1. Absorption spectrum of Iodine
2. e/m- Magnetron & Thermionic work function
3. Susceptibility-Quincke's method
4. Experiments with Laser-I
5. Elastic constants-Hyperbolic fringes method
6. Determination of Planck's constant & Dielectric constant – Wave meter
7. Hall effect in Semiconductor
8. Determination of Energy gap of semiconductor
9. UJT Characteristics and applications
10. Regulated Power Supply – Zener and IC
11. Op. Amp – I to V and V to I converters
12. Wien's Bridge Oscillator (Transistor&op-amp)
13. 555 Timer (Astable Multivibrator &Schmitt trigger) and its applications
14. Logic expression – Simplification using Karnaugh Map and implementation (SOP and POS) – Basic and Universal gates.
15. Parity Generator /Checker and Digital comparator
16. Op. amp – Square wave generator
17. SCR Characteristics and applications
18. Liquid Crystal Display.
19. L.G. Plate
20. G.M. counter
21. Dielectric constant of Liquids and Solids by capacitance method.

Sem – I Hours / week : 4
10 PPH 1201A Credits : 4

ELECTIVE – I: NUMERICAL AND COMPUTATIONAL PHYSICS

Objectives:

- *To understand different numerical methods and their applications.*
- *To understand different computational techniques for physics applications.*

UNIT I : NUMERICAL SOLUTION OF LINEAR AND NONLINEAR EQUATIONS (12 Hrs)

Newton – Raphson method: iterative rule – termination criteria – rate of convergence – drawbacks — Simultaneous linear algebraic equations: – Augmented matrix — Gauss elimination – Jordan's modification – Inverse of a matrix by Gauss-Jordan method

UNIT II : INTERPOLATION AND CURVE FITTING (12 Hrs)

Interpolation: Newton's interpolation - Linear interpolation – Higher-order polynomials – Divided differences — Gregory-Newton forward and backward interpolation formulae – error in interpolation — Lagrange interpolation.

Curve fitting: Method least-squares- normal equations – straight-line, exponential fits and power-law fits..

UNIT III: NUMERICAL DIFFERENTIATION, INTEGRATION AND ODE (12 Hrs)

First and second-order derivatives: central difference formulae

Numerical integration: trapezoidal, Simpson's 1/3 rules – Truncation error – composite trapezoidal, and Simpson's 1/3 rules. ODE: Euler and fourth-order Runge-Kutta methods for first order ODE.

UNIT IV: PROGRAMMING IN C (12 Hrs)

Programming methodologies – Scientific programming languages – Programming in C- Variables-expressions and statement- operators-library function- data input and output – structure of C programming- control statements- functions- global variables-arrays- Character-strings - Structures.

UNIT V : COMPUTATIONAL PHYSICS (12 Hrs)

Developing Algorithm and C-Programming for: Motion of a projectile including air drag (Feynmen –Newton method) – Motion of a satellite around a planet — Young's double-slit interference – Diffraction using a grating – Electric field due to a point charge and N charges — Nonlinearity study of rectifier output, Energy analysis in RL Circuit (Euler method),

BOOKS FOR STUDY:

1. M.K. Venkataraman, Numerical Methods in Science & Engineering National Pub. Co. Madras, 1993. (for units I,II,and III)
2. E. Balagurusamy ANSI C (for unit IV)
3. E Balagurusamy, Numerical Methods, Tata MC Graw Hill, New Delhi (1999) (for unit V)

Semester – I Hours / Week : 4
10 PPH 1201B Credit : 4

ELECTIVE – I: EXPERIMENTAL TECHNIQUES AND INSTRUMENTATION

Objectives:

- *To understand the experimental data analysis and to know the instrumentation techniques*.

Unit I: DATA INTERPRETATION AND ANALYSIS (12 Hrs)

Types of errors – systematic and random errors – Accuracy and precision – significant figures and round off – uncertainties and probable error – Random variable – mean, variance and standard deviation – Normal distribution – sampling techniques – propagation of errors – estimates of mean and errors: instrumental uncertainties – statistical fluctuations – Chi square test – goodness of fit.

Unit II: GENERAL MEASUREMENT AND SIGNAL PROCESSING (12 Hrs)

Measurement of: (i) time and energy (ii) fundamental constants e, h, c (iii) high and low resistances, L and C. Q-meter – use of signals from detectors and associated instrumentation. I / O devices – analog displays and recorders, digital devices.

Unit III: VACUUM TECHNIQUES (12 Hrs)

Basic idea of conductance – pumping speed, Pumps: mechanical, diffusion types. Gauges: Thermocouple, Penning and Pirani Hot cathode, low temperature cooling a sample, high temperature.

Unit IV: MATERIALS CHARACTERIZATION (12 Hrs)

Structural analysis – single crystal XRD, Microhardness, conductivity, impedance analysis – LCR bridge – optical –FTIR-UV-absorbance-transmittance-reflectance.

Unit V:SENSORS AND TRANSDUCERS (12 Hrs)

Inductive, capacitive and resistive transducers, Force, pressure, temperature, humidity,light, magnetic and ultrasonic flow sensors. (Load cell, LVDT, potentiometric, moderate low, high pressure sensors, Thermo, thermistior, RTD, LDR, solar cell, photodiode, hall probe – piezoelectric, flow sensors)

Books for study:

1. B.C Nakra and K.K.Chaudry – Instrumentaion Measurement and Analysis – Tata McGraw Hill, New Delhi
2. A.K.Sawhney – A Course in Electrical and Electronic Measurements and Instruments.
3. Willard etal – Instrumentation method and Analysis.

Semester II Hours / Week : 6
10 PPH 2105 Credit : 5

QUANTUM MECHANICS

Objectives

- *To understand basic idea of Dirac formalism to Quantum Mechanics.*
- *Apply the same formalism to study the angular momentum concept, scattering of fundamental particles and necessary relativistic modification in particle behaviour.*

UNIT – I : DIRAC'S FORMALISM (15 Hrs)

Bra and Ket notations – Linear operations – Orthogonality of eigen functions – observables – the completeness condition – simultaneous eigenkets of commuting observables – eigen value problem – uncertainty product – harmonic oscillator wave functions – the coherent state – time evolution of the coherent state – the number operator – the unitary transformation.

UNIT – II : ANGULAR MOMENTUM (15 Hrs)

The angular momentum operator – eigen values and eigen functions of L2 – The commutation relations – angular momentum and rotations – ladder operators – the constants C+ and C- - angular momentum matrices corresponding to j = ½ and j = ½ - Pauli spin matrices – Pauli wave function and Pauli equation – addition of angular momenta – Clebsh – Gordan Coefficients – concept of isospin.

UNIT – III : APPROXIMATION METHODS (15 Hrs)

JWKB solutions – the connection formula – application of JWKB method to alpha decay – time independent perturbation theory – non-degenerate (first and second order) states – degenerate states – variational method – hydrogen and helium atoms – time dependent perturbation theory – Fermi's Golden rule – Adiabatic approximation – sudden approximation.

UNIT – IV : THEORY OF SCATTERING (15 Hrs)

The Green's function technique – the Born approximation – Rutherford scattering formula – partial wave analysis – external and internal logarithmic derivatives – the square well potential – scattering cross section and the optical theorem – the complex potential – very low energy scattering – the scattering length – the effective range theory with potential and without potential – low energy neutron – proton scattering.

UNIT – V : RELATIVISTIC WAVE EQUATIONS (15 Hrs)

The Klein – Gordan equation – the Dirac Equation – Dirac's a and b matrices – the continuity equation – the free particle solutions – the hole theory – spin of the Dirac electron – magnetic dipole moment of the electron – the velocity operator – expectation value of the velocity – relativistic invariance of Dirac equation.

BOOKS FOR STUDY

1. A. Ghatak and S. Lokanathan, Quantum Mechanics, Macmillam India Ltd., New Delhi, 2005.
2. V. Devanathan, Quantum Mechanics, Narosa Publishing House, New Delhi, 2006.

Book	Chapters	Sections
1	11, 12	11.1 – 11.6, 11.8, 12.1 – 12.5, 12.7 – 12.10
1	9, 13, 18	9.1-9.5, 13.1-13.6, 18.1 – 18.4
1	17, 19, 21, 25	17.1 – 17.4, 17.7, 19.1-19.3, 21.1 – 21.3, 25.1- 25.2, 25.4, 25.5
2	9	9.1 – 9.4 (except 9.3.2 and 9.3.5)

BOOKS FOR REFERENCE

1. Thankappan, V.K. – Quantum Mechanics, Wiley Eastern Ltd., New Delhi, 2nd Edn, 1995.
2. G. Aruldhas, Quantum Mechanics, Prentice Hall of India, New Delhi, 2003.

Semester – II Hours / Week : 6
10PPH 2106 Credit : 5

ELECTRODYNAMICS & PLASMA PHYSICS

Objective:

- *To know the basics of electrostatics and magnetostatics*
- *To acquire knowledge of wave propagation in different median and flow of power.*
- *To understand reflection of EM waves in conductor and dielectric and the analogue of EM wave.*
- *To understand the modes of propagation of guided waves and propagation through wave guides .*
- *To understand the concepts of plasma physics.*

Unit I: ELECTROSTATICS AND MAGNETOSTATICS (15 Hrs)

Gauss's law & its applications –the potential function- Laplace & Poisson's equations – condition at a boundary between dielectrics – Divergence theorem – electrostatic uniqueness theorem – magnetic field strength and magneto motive force – Ampere's law – Biot Savart law - Ampere's law in differential vector form – magnetic scalar and vector potential - electromagnetic induction - Lorentz transformation and relations for relative motion.

Unit II: APPLIED ELECTROMAGNETIC WAVES (15 Hrs)

Equation of continuity for time varying fields – inconsistency of ampere's law - Maxwell's equations – derivations – electromagnetic waves in free space – uniform plane wave propagation and its characteristics – wave equations for conducting medium – Maxwell's equation in phasor form – wave propagation in lossless, conducting and dielectric media – depth of penetration

Unit III :ELECTROMAGNETIC WAVES IN BOUNDED MEDIA & POWER FLOW (15 Hrs)

Poynting's theorem - statement and proof – Interpretation of Poynting's vector - Power flow for a plane wave – power flow in a concentric cable and conductor having resistance – Instantaneous, average and complex Poynting vector – power loss in a plane conductor and a resonator -Boundary conditions – proof – reflection of plane waves by a perfect conductor for normal and oblique incidence – reflection of plane waves by a perfect dielectric for normal and oblique incidence – Brewster's angle.

Unit IV : GUIDED WAVES AND WAVE GUIDES (15 Hrs)

Waves between parallel planes – Transverse electric waves – Transverse magnetic waves characteristics of TE and TM waves – Transverse electromagnetic waves – Attenuation in parallel plane guides – Attenuation for TE waves, TM waves and TEM waves – Rectangular guides – Transverse magnetic waves and Transverse electric waves in rectangular guides – Field configurations for dominant TM and TE modes - Impossibility of TEM wave in wave guides – Transmission line analogy for wave guides - Q factor of wave guides

Unit V : PLASMA PHYSICS (15 Hrs)

Introduction – kinetic theory of plasma – principle of detailed equilibrium – mathematical aspects of plasma physics – Maxwell's equation – hydrodynamic equation – momentum transfer equation – equations of continuity – production of plasma – plasma oscillation – electrical conductivity of plasma – thermal pinch effect – dielectric properties – magnetic properties – observation of plasma radiation using diagnostic technique. .

Books For Study:

1. Edward C, Jordan & Keith G., Balmain, *Electromagnetic Waves and Radiating Systems*, -Second Edition, Prentice Hall of India, New Delhi, 1997.
2. B.S.Saxena, P.N.Saxena & R.C.Gupta, *Fundamentals of Solid State Physics*, Pragati Prakasan publn, 1978.

Unit	Book	Section
I	1	2.03,2.04,2.07,2.08,2.11,2.13,3.04, 3.05,3.10,3.11,3.12,3.14,18.06,18.10,18.13
II	1	4.01 – 4.03, 5.01– 5.06
III	1	4.04, 5.09 – 5.15, 6.01 – 6.04
IV	1	7.01 – 7.05, 7.07, 8.01 – 8.04, 8.09, 8.10
V	2	19.1, 19.8, 19.9, 19.11, 19.13, 19.14

Books For Reference :

1. David I.Griffiths, *Introduction to Electrodynamics,* Prentice Hall of India, New Delhi, 2003
2. Slater and Frank " Electromagnetism"
3. B.B.Laud, *Electromagnetics,* second edition, Wiely Eastern Limited,1990.

Semester – II Hours / Week : 6
10 PPH 2107 Credit : 5

MICROPROCESSOR AND MICROCONTROLLER

Objectives:

- *To understand the Microprocessor and Microcontroller architecture.*
- *To program the processor and controller.*
- *To know the interfacing applications.*

Unit-I MICROPROCESSOR ARCHITECTURE, INSTRUCTION SET AND INTERFACING (15 Hrs)

Intel 8085 Microprocessor Architecture, Pin configuration, Instruction cycle, Timing diagram, Instruction and data formats, Addressing modes, Status flags, Intel 8085 instructions. Address Space partitioning, Memory and I/O Interfacing, Data transfer schemes, Interrupts of Intel 8085. Generation of control signals for memory and I/O devices

Unit-II MICROPROCESSOR PROGRAMING (15 Hrs)

Assembly language, Stacks, Subroutines, MACRO, Delay Subroutine. Examples of Assembly language Programming- addition-subtraction –complement- shift –mask-look-up table- To find the largest and smallest number in a data array- sorting-sum of a series-Multiplication- Division- multi-byte addition and subtraction.

Unit – III Microcontroller – 8051 (15 Hrs)

Microprocessor and Microcontroller – Overview of 8051 Family – Pin Description of 8051 – Registers - Program Counter, ROM space, RAM space, Stack, PSW, SFR – Addressing Modes – Jump Call Instructions – Time delay generations and Calculations - Arithmetic and Logic Instructions – Bit Instructions – Assembly Language Programming – Data Types and Directives.

Unit – IV Microcontroller SFRs and Programming (15 Hrs)

Counter/Timer – Counter Programming – Basics of Serial Communication – RS232 Connections and ICs Max 232, 233 – 8051 Serial Communication Registers - Serial Communication

Programming – Interrupts – Interrupts Registers – Internal and External Interrupt Programming.

Unit-V MICROPROCESSOR AND MICROCONTROLLER APPLICATIONS (15 Hrs)

Microprocessor Interfacing and Applications:

Programmable peripheral interface Intel 8255, Interfacing 7 segment LED display, Measurement of frequency, voltage and current, Measurement of temperature. Microprocessor based traffic control, To generate square wave or pulse using Microprocessor.

Microcontroller Interfacing and Applications:

Interfacing – LCD, ADC 0809, Stepper Motor, Keyboard and DAC.

BOOKS FOR STUDY:

1. B. Ram, Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai Publications (P) Ltd., New Delhi (2005).
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi – The 8051 Microcontroller and Embedded Systems, Pearson Education, Delhi, Seventh Indian Reprint 2004.

Unit	Book	Sections
I	1	3.1,3.3, 4.1, 4.4, 4.6, 7.2, 7.5, 7.6.1
II	1	5.2, 5.5, 5.6, 5.14, 9.2, 6.1-6.32, 6.34, 6.35
III	2	1.1,1.2,4.1,2.1,2.4,2.7,2.6,5.1,5.2,3.1,3.2,3.3,6.1,6.2, 6.3, 7.1, 7.2, 7.3,8.1, 8.2, 2.2, 2.3, 2.5
IV	2	Chapter 9, 10, 11
V	1	
	2	7.7.1-7.7.4, 8.8, 9.3, 9.5.1, 9.5.3, 9.6.1, 9.8, 9.9 Chapter 12, 13

Books For Reference

1. A.P.Godse and D.A.Godse, Microprocessors and its applications (First edition), Technical Publications, Pune , 2006.
2. A.Nagoor Kani,Microprocessors & Microcontrollers,1st edition, RBA Publications, Chennai, 2006.

Semester – II Hours/Week : 8
10 PPH 2108 Credits : 5

M.Sc - PHYSICS PRACTICAL – II

Any 15 of the following

1. Susceptibility-Guoy's method
2. Elastic constants-Elliptic fringes method
3. V-I Characteristics of Solar Panel and Photosensitive devices
4. Biprism-Wave length and thickness
5. Ultrasonic diffraction
6. Ultrasonic interferometer
7. Experiments with Laser-II
8. e-Millikan's oil drop method
9. BCD adder and subtractor
10. DIAC and TRIAC characteristics and applications
11. Power Amplifier – Transistor and IC
12. 555 Timer (Monostable Multivibrator) and its applications
13. Study of sensors and differential and instrumentation amplifier using Op.Amp
14. Arithmetic Logic Unit, Scalars and display devices.
15. Encoders and Decoders
16. PCB design and construction.
17. Op. amp- Voltage to frequency converter
18. Active Filters using Op. amp.
19. Phase Locked Loop.
20. F.P. Etalon
21. Gamma ray spectrometer

Semester -II Hours / Week: 4
10 PPH 2401 Credit: 4

INTER DEPARTMENTAL COURSE : MODERN PHOTOGRAPHY

Objectives

- *To make the students know the techniques of exposure and developing of film rolls*
- *To make the students know how to print using enlarger*
- *To make the students know how to handle digital and video cameras.*
- *To edit the digital images and to mix the video and Audio.*

UNIT I: CAMERAS, LENSES AND FLASH (12 Hrs)

The Traditional camera – Types of cameras – modern reflex, SLR, TLR, subminiature and Polaroid cameras – Interchangeable Lenses – Telephoto Lens, wide angle lens, Zoom and macro Lenses – Depth of field – Film speed – Light and exposure – Flash.

UNIT II: DEVELOPING, PRINTING AND TONING (12 Hrs)

The constituents of the developer –Other chemicals in need- Developing the film- Tank Development- Defects in the negatives – Enlarging – Faults in enlarging and their causes – Toning of Prints – Sepia toning only.

UNIT III: COLOUR AND DIGITAL PHOTOGRAPHY (12 Hrs)

Colour Photography - Light and colour- Filters for colour – The colour quality – Processing of colour films – Digital Photography – Digital still camera and their parts- Types of digital camera-The view finder- Optical and LCD display.

UNIT IV: DIGITAL PHOTOGRAPHY – IMAGE: STORING, EDITING AND CROPPING (12 Hrs)

The CCD chips- Storing images- Optical / Digital zooms - Composing the picture – connecting the camera to a computer –

Image editing using software – Cropping- Colour levels- Special effects- Adding text.

UNIT V: VIDEO PHOTOGRAPHY (12 Hrs)

Video Camera – Principle of a camera tube –Types of camera tubes- Block diagram of a video camera and their parts – Handling operations and precautions for the use of a video camera – Video and Audio mixing using software – PC Digital Video and its applications

BOOKS FOR STUDY

1. O.P. Sharma – 'Practical Photography', Hind Pocket Books (P) Ltd, 1997 (For unit I, II and part of III Colour Photography).
2. Alex May – 'Digital photography', A Dorling Kindersley Book, London, 2000. (For part of III and Unit IV)
3. Lecture Notes. (For Unit V).

Semester : III Hours/ Week : 6
10 PPH 3109 Credit : 5

STATISTICAL MECHANICS

Objectives

- *To review the fundamental concepts of thermodynamics in order to understand Statistical Mechanics.*
- *To understand the principles of classical statistical mechanic and its application to compute the various parameters of molecules.*
- *To understand the need for quantum Statistical Mechanics and its various applications.*
- *To know the concept of Boltzmann transport equation and its applications and the principle of fluctuations in thermodynamic quantities.*
- *To acquire knowledge about the phase transition of a system and its models.*

Unit 1: Foundation and fundamentals of Statistical Mechanics (15 Hrs)

Entropy and second law of the thermodynamics- Entropy and disorder- thermodynamic potentials and the reciprocity relation- thermodynamic equilibrium-Nernst's heat theorem- chemical potential-phase space-volume in phase space-concept of ensembles-micro canonical- canonical- grand canonical- Liouvilles theorem- statistical, thermal, particle equilibrium-micro and macro states- Gibb's paradox.

Unit 2 :Classical statistical mechanics (15 Hrs)

Classical Maxwell-Boltzmann distribution law- evaluation of constants- distribution of velocities- principle of equipartition of energy-connection between the partition function and thermodynamic quantities- mean values obtained from distribution law- Boltzmann's entropy relation- theory of imperfect gases-partition function-equation of state and virial coefficients.

Unit 3 :Quantum Statistical mechanics (15 Hrs)

Statistical weight- density of matrix- Bose-einstein Statistics-Fermi-Dirac Statistics- Maxwell-Boltzmann- black body radiation and

Plancks radiation law-energy and pressure of bose-einstein and fermi-dirac-gas degeneracy- bose-einstein condensation-electron gas- free electron model and electronic emission.

Unit 4:Transport properties and fluctuations in thermodynamic quantities (15 Hrs)

Boltzmann transport equations-Boltzmann transport equations for electrons and Lorentz solution-chambers equation-thermal conductivity of metals- fluctuations in energy, pressure, volume and enthalpy –probability of one dimensional random walk- Brownian movement- Fokker Planck equation- solution on Fokker-Planck equation- Nyquist's theorem.

Unit 5:Phase transitions and its models (15 Hrs)

Phase transitions-first and second kind – YANG and LEE theory - critical exponent-phase transition of second kind- Ising model - Bragg Williams approximation- one dimensional Ising model

Book For Study:

1. Gupta S.L & Kumar V., Statistical Mechanics, Pragati Prakashan, Meerut, 2004

Unit	Book	Sections
I	1	A.2-7,1.1,1.1.1,1.3,1.7,1.10-1.13,2.1,3.0.3
II	1	2.7,2.9,2.10,2.12,2.14,2.15-2.17,4,4.1,4.2
III	1	5.9,5.11,6.2,6.3,6.4,6.10,8.0-8.3,9.0,9.3,9.4
IV	1	10.1-10.3,10.5,12.1-12.8,12.10
V	1	13.1-13.7,8.4.0,8.4.1,8.4.2

Books For References.

1. Gopal E S R,StatisticalMechanics& Properties of Matter, McMillan,NewDelhi1976.
2. Agarval B K & Melin Eisner., Statistical Mechanics, Wiley Eastern Ltd, NewDelhi 1989.
3. *Palash b.Pal An introductory course of statistical mechanics, Narosa, NewDelhi,2008.*

Semester : III Hours/ Week : 6
10 PPH 3110 Credit : 5

ATOMIC AND MOLECULAR SPECTROSCOPY

Objectives:

- *To acquire the knowledge of interaction electromagnetic radiation with atoms and molecules and study the different types of spectra*
- *To know the spectroscopic techniques to used in finding the molecular structure, bond angles, bond length etc.*
- *To apply the Laser technology in today and tomorrow in different fields.*

Unit I : ATOMIC SPECTROSCOPY (15 Hrs)

Investigation of spectra – Theoretical principles – quantum states of an electron in an atom- Hydrogen atom spectrum – electron spin and Stern-Gerlach experiment – spin –orbit coupling- fine structure- spectroscopic terms and selection rules- Hyperfine structure- Pauli exclusion principle- Alkali type spectra- LS&JJ coupling- Zeeman effect, Pachen-back effect, Stark effect, X-ray spectra

Unit-II :ROTATIONAL AND VIBRATIONAL SPECTROSCOPY (15 Hrs)

The Rotation of the molecule- Rotational spectra-Rigid diatomic molecule- The intensities of spectral lines-effect of isotopic substitution- the non-rigid rotator – Techniques and instrumentation – applications.

The vibrating diatomic molecule- The Simple harmonic oscillator- The anharmonic oscillator-Diatomic vibrating rotator- Born –Oppenheimer approximation- Techniques and instrumentation-applications.

Unit- III :RAMAN AND ELECTRONIC SPECTROSCOPY (15 Hrs)

Introduction- classical & quantum theory of Raman effect-spectra- Pure rotational Raman spectra- Vibrational Raman spectra-Techniques and instrumentation -Applications Electronic spectra of diatomic molecules – Born – Oppenheimer Approximation—Vibrational coarse structure- Franck- Condon Principle-Dissociation energy- Rotational fine structure of electronic vibration- Fortrat diagram.

Unit –IV : RESONANCE SPECTROSCOPY (15 Hrs)

Introduction- Nature of spinning particle- Interaction between spin and a magnetic field- Larmor Precession – Theory of NMR- Chemical shift- relaxation Mechanism- Experimental study of NMR- Theory and experimental study of NQR- Theory of ESR-Hyperfine structure and fine structure of ESR- Experimental studies and applications- Mossbauer spectroscopy- Principle-Isomer shift- quadrupole effect - effect of magnetic field – Instrumentation- applications.

Unit – V : LASER and HOLOGRAPHY (15 Hrs)

Introduction – Spontaneous and stimulated emission Einstein A and B coefficients- Basic Principles of Laser- Population Inversion- Two level and Three level Laser system- optical pumping – rate equation – modes of resonator and coherence length — Ruby Laser- He- Ne Laser- CO2 Laser- Semi conductor Laser- Liquid Laser-– Principle of Holography- Theory – Practical applications including data storage, security, and art .

BOOKS FOR STUDY

UNIT	Name and Author of Book	Chapters	Sections
I	Elements of Spectroscopy S.L.Gupta, V.Kumar & R.C. Sharma, Pragati R\Prakashan Publications , 9th Edition , 2006	1,3,6,7,9, 12,13,15	1.2, 1.4.1, .1.4.2, 3.1, 3. 1.1, 3, 3.5.17, 3.8, 6.10. 6.13, 6, 14.2, 7.1, 7.2, 7.6, 7.7,9.1,9.2,9.12, 12,13,15
II	Fundamentals of Molecular Spectroscopy- Colin N.Banwell, & Elaine Tata Mc Graw hill, New Delhi,1994	2,3	2.1, 2.2, 2.3, 2.3.1-2.3.5, 2.5, 2.63.1, 3.1.1-3.1.3,. 2,3.6, 3.6.1-3.6.3, 3.8
III		4,6	4.1, 4.1.1-4.1.2, 4.2 4.2.1-4.2.3, 4.3,4.3.1-4.3.5, 4.6 6.1.1-6.1.3, 6.1.5-6.1.7, 6.4
IV		7	7.1.1-.7.1.5,7.2.1,7.4,7.5,7.5.1-7.5.3,7.5.5,7.5.6,8.,9.1-9.2.3
V	Lasers and Non-Linear Optics- B.B. Laud, New Age International Ltd, Revised 2nd Edition 2007	1,4,6,7,8, 9,10, 12,17,	1.1-1.4, 4.1, 6.1, 6.2, 6.3, 6.8, 6.10, 7.1, 8.1, 8.5.1, 9.1, 9.2, 10.1,12.1,12.2, 12.4, 12.5, 17.7-17.15

BOOKS FOR REFERENCE:

1. Straughan B.P and Walker .S., Spectroscopy – Vol.1,2,3, Chapmanand Hall London ,1996
2. Molecular Spectroscopy – G.Aruldhas
3. Thyagarajan .K & Ghatak .A.K ., Lasers – Theory and Applications Macmillan India Ltd, New Delhi 1997

Semester – III Hours / Week : 4
10 PPH 3202A Credit : 4

ELECTIVE – II: COMMUNICATION PHYSICS

Objectives

- *To acquire knowledge about analog and digital modulation and demodulation techniques*
- *To understand the concepts and techniques involved in communication by optical fiber and satellite*
- *To learn the working principles of telephone, fax and cell.*

Unit I: SINGLE SIDEBAND COMMUNICATION SYSTEMS (12 Hrs)

Single sideband systems - mathematical analysis of suppressed carrier AM- ring and FET push pull balanced modulators - single side band transmitters and BFO receivers - ISB.

Unit II: ANGLE MODULATION (12 Hrs)

Angle modulation - mathematical analysis - phase deviation and modulation index - frequency deviation and percent modulation - deviation ratio - commercial broadcast band FM - Direct FM and P M modulators using varactor diode - frequency up conversion - phase locked loop direct FM transmitter - Armstrong indirect FM transmitter - FM receiver block diagram - FM de modulation using PLL only - limiter circuits - FM vs PM.

Unit III: DIGITAL MODULATION, TRANSMISSION, MULTIPLEXING (12 Hrs)

Introduction to digital modulation, ASK, FSK, PSK modulation principle only - high speed Modems - dual four level converters. Digital transmission - pulse modulation - PAM-TDM-PWM-PPM-FDM-PCM.(Concept only)

Unit IV:OPTICAL FIBER COMMUNICATIONS (12 Hrs)

Optical fiber communications- optical fiber types - Advantages and disadvantages of optical fiber cables - Block diagram of an

optical fiber communication system- light propagation-optical fiber configurations and classifications-losses in optical fiber cables-light sources and optical sources- light detectors.

UNIT V:CELLULAR TELEPHONE COMMUNICATIONS (12 Hrs)

Cellular telephone concepts- Mobile telephone service-evolution of cellular telephone-cellular telephone-frequency reuse-interference-cell splitting, sectoring, segmentation and dualization-cellular system topology-roaming and handoffs-cellular telephone network components. Second generation cellular telephone systems – digital cellular telephone - global system for mobile communications.

BOOK(S) FOR STUDY

1. Wayne Tomasi ,Electronic Communications Systems, (Fundamentals through advanced) Fifth Edition, Pearson Education, Inc 2006.
2. Robert J Schoenbeck-Electronic Communications, Prentice Hall of India, New Delhi, 2002.

Unit	Book	Sections
I	1	6.2 – 6.4, 6.5.1, 6.5.2, 6.6, 6.7, 6.8.1, 6.8.2
II	1	7.1-7.3, 7.5-7.8, 7.11, 7.12, 7.17.1.1, 7.17.2.1, 7.18, 7.19.2, 7.20, 7.21, 8.1-8.4, 8.6.2, 8.7
III	1 2	9.1, 9.3-9.5, 10.1-10.3, 15.14, 15.14.3, 15.15, 15.19, 15.19.1-15.19.4, 15.20
IV	1	13.1-13.13
V	1	19.1-19.10, 20.4, 20.6, 20.9, 20.10

Sem – III Hours / week : 4
10 PPH 3202B Credits : 4

ELECTIVE – II: ADVANCED QUANTUM MECHANICS

Objectives:

· *To understand the advanced concepts and applications*.

UNIT – I : MANY ELECTRON SYSTEMS - I (12 Hrs)

Independent particle approximation – electron interaction energy – Variation method – exchange degeneracy and identical particles – Pauli exclusion principle – excitation states of Helium – fine structure – Helium spectra.

UNIT – II : MANY ELECTRON SYSTEMS - II (12 Hrs)

Central field approximation – wave function – shells and subshells – hartree's method of self consistent field – Application to Helium – Hund's Rule – Coupling Schemes.

UNIT – III : CONCEPTS OF RADIATION (12 Hrs)

Semi Classical Theory of Radiation: The Einstein's Co-efficients – the Atom – field interaction – Spontaneous emission – selection rules. Quantum Theory of Radiation: The Hamiltonian – the interaction term – quantisation of radiation field – spontaneous and stimulated emissions – Properties of the hamiltonian of the radiated field.

UNIT – IV : SECOND QUANTIZATION (12 Hrs)

Second Quantisation: Non relativistic Schroedinger equation – Occupation number formalism – Applications occupation number formulism to particle – hole excitations.

UNIT – V : NON – RELATIVISTIC FIELDS (12 Hrs)

Systems of Bosons and Fermions. Relativistic fields: Natural system of units, Klein Gordan field, Electronmagnetic field, Interacting field.

BOOKS FOR STUDY

1. Thankappan, V.K : Quantum Mechanics, 2nd edn, (New Delhi: Wiley Eastern Ltd., 1995)

2. Ghatak, A.K. & Lokanathan, S: Quantum Mechanics Theory and application, (3rd edn) (New Delhi:Macmillan India Ltd., 1996)

UNIT	BOOK	CHAPTERS	SECTIONS
I	2	15, 16, 18	Full chapter
II	2	21, 22	21.1 – 21.5, 22.1 – 22.5
III	1	11	11.3, 11.4 (A, C) - 11.5

Semester -III Hours/Week : 4
10PPH 3402 Credit : 4

INTER DEPARTMENTAL COURSE : MEDICAL PHYSICS

Objectives

- *To acquire knowledge of forces, pressure and the importance of temperature in human body.*
- *To understand the physics principles involved in respiration and cardiovascular system.*
- *To understand how electric signals generate in human body and the working of EMG and ECG.*
- *To understand the application of sound and light in medicine and medical imaging.*
- *To understand the use of X – rays and radioactivity for diagnosis and treatment.*

Unit I MECHANICS OF HUMAN BODY (12 Hrs)

Static, Dynamic and Frictional forces in the Body – Composition, properties and functions of Bone – Heat and Temperature – Temperature scales – Clinical thermometer – Thermography – Heat therapy – Cryogenics in medicine – Heat losses from Body – Pressure in the Body – Pressure in skull, Eye and Urinary Bladder.

Unit II PHYSICS OF RESPIRATORY AND CARDIOVASCULAR SYSTEM. (12 Hrs)

Body as a machine – Airways – Blood and Lungs interactions – Measurement of Lung volume –Structure and Physics of Alveoli – Breathing mechanism – Airway resistance – Components and functions of Cardiovascular systems –work done by Heart – Components and flow of Blood – Laminar and Turbulent flow – blood Pressure – direct and indirect method of measuring –Heart sounds.

Unit III ELECTRICITY IN THE BODY (12 Hrs)

Nervous system and Neuron – Electrical potentials of Nerves – Electric signals from Muscles, Eye and Heart – Block diagram and

working to record EMG - Normal ECG wave form – Electrodes for ECG – Amplifier and Recording device – Block diagram and working to record ECG – Patient monitoring – Pace maker.

Unit IV SOUND AND LIGHT IN MEDICINE (12 Hrs)

General properties of sound – Stethoscope - Generation, detection and characteristics of Ultrasound –Ultrasound imaging technique – A scan and B scan methods of ultrasound imaging – properties of light – Applications of visible UV, IR light, and Lasers in medicine – Microscope – Eye as an optical system – Elements of the Eye – Ophthalmology Instruments.

Unit V DIAGNOSTIC X-RAYS AND NUCLEAR MEDICINE (12 Hrs)

Production and properties of X-rays – Basic Diagnostic X-ray Machine – X-ray image – Live X-ray image – X-ray computed Tomography – Characteristics of Radio activity – Radioisotopes and Radio nuclides – Radioactivity sources for Nuclear medicine – Basic Instrumentation and clinical applications – Principles of Radiation Therapy – Nuclear medicine imaging devices – Radiation sources

BOOK FOR STUDY

Medical Physics by Department of Physics, St. Joseph's College, Trichy-2.

BOOKS FOR REFERENCE

1. John R. Cameron and James G. Skofronick, John Wiley & Sons - Medical Physics, Wiley – Interscience Publications, 1978.
2. R.S.Khandpur - Hand book of Biomedical Instrumentation, Tata McGraw Hill Publication Co., Delhi, 1987.

Semester – III Hours/Week : 8
10 PPH 3111 Credits : 5

M.Sc - PHYSICS PRACTICAL – III

Any 15 of the following

1. e/m – Zeeman effect
2. Microwaves – Klystron
3. Spectrum photo-Cu, Fe-Arc spectra
4. Transmission line characteristics
5. Michelson's Interferometer
6. Dielectric constant – Lecher wires
7. Rydberg's constant
8. Experiments with Laser-III
9. D/A Converter using op. Amp
10. A/D converter- Parallel comparator
11. Shift Register construction using Flip-Flops, and Shift Register IC study.
12. Multiplexer and Demultiplexer
13. Microprocessor Programming – I - Data transfer and Rotate operations
14. Microprocessor Programming – II-Arithmetic operations, Addition, Subtraction Multiplication and Division
15. Microprocessor Interfacing – III – Traffic control
16. Microprocessor Interfacing – IV – Stepper Motor control
17. Microcontroller – Programming and Interfacing.-I
18. Microcontroller – Programming and Interfacing.-II
19. Frequency Multiplier
20. Multiplexed display system

Semester : IV Hours/ Week : 6
10 PPH 4112 Credit : 5

NUCLEAR, PARTICLE AND ASTROPHYSICS

Objectives:

- *To understand the basic structure and properties of the nucleus.*
- *To know the causes and mechanism of natural radioactivity.*
- *To differentiate different types of nuclear reactions and to apply this knowledge for producing fission and fusion energy.*
- *To understand the properties of various fundamental particles, their decay and the interactions. To study the aspects and importance of astrophysics and radio astronomy.*

Unit I : BASIC PROPERTIES OF NUCLEUS (15 Hrs)

Nuclear mass and binding energy - atomic masses – systematics of nuclear binding energy – nuclear size – charge radius – potential radius - spin and parity – statistics of nuclei – magnetic dipole moment – electric moments – electric quadrupole moments – isospin – nuclear forces – ground state of the deutron – wave equation for the deutron and solution – excited state of deutron – low energy proton neutron scattering – spin dependence of n-p interaction – nuclear models –liquid drop model - Bohr-Wheeler theory of fission – Experimental evidence for shell effects – Shell model

Unit II : NUCLEAR DECAY AND RADIOACTIVITY (15 Hrs)

Theory of alpha disintegration – hindrance and formation factors – fine structure of alpha decay – energetics of beta decay – neutrino hypothesis - Fermi theory of beta decay – selection rules – Sergent diagram – orbital electron capture – parity non conservation – double beta decay – gamma ray spectra and nuclear energy level – radio active transition in nuclei – nuclear isomerism – internal conversion – resonance fluorescence – angular correlation

Unit III : NUCLEAR REACTIONS (15 Hrs)

Types of nuclear reactions – conservation laws – reaction energetics – Q value – threshold energy – nuclear reaction cross section – partial wave analysis – level width – compound nuclear theory – Briet Wigner dispersion formula – direct reaction – stripping and pickup reactions – nuclear fission – energy released in fission – nuclear chain reaction – four factor formula – nuclear reactor – disposal of radio active waste – nuclear fusion – stellar energy – thermonuclear weapons - trace element analysis – diagnostic nuclear medicine – therapeutic nuclear medicine

Unit IV : PARTICLE PHYSICS (15 Hrs)

Production of new particles in high energy reaction – classification of elementary particle – fundamental interaction – Quantum numbers – anti particles – resonances – laws in production and decay process - symmetry and conservation laws – special symmetry groups – Gelman Neeman theory – Quark model – SU3 symmetry – unification of fundamental interaction, C,P and T invariance and applications of symmetry arguments to particle reactions, parity non-conservation in weak interaction, Relativistic kinematics

Unit V : ASTROPHYSICS AND RADIO ASTRONOMY (15 Hrs

Physical properties of stars – life cycle of a star – end products of stellar evolution – structure of milky way – expanding universe – future prospects – Radio astronomy – Historical developments – Synchrotron radiation - spectral lines in radio astronomy – a few major discoveries in radio astronomy – Radio astronomy in India – Hot big bang cosmology - Recent developments

Books For Study :

1. S.N. Ghoshal, Nuclear Physics, S.Chand and company Ltd, 2003.
2. Satya Prakash, Nuclear physics and particle physics, Sultan Chand and sons, First edition 2005.
3. Joshi A.W, Horizons of Physics, Wiley Eastern Ltd

Unit	Book	Sections
I	1	2.1 –2.13, 17.2, 17.3, 17.4, 17.6 , 17.8
II	1	4.9-4.12, 5.5- 5.7, 5.9, 5.10, 5.13, 5.17, 5.19
III	2	8.1, 8.2, 8.4, 8.5, 8.9, 8.10, 8.12, 8.13, 8.15, 8.16, 9.2, 9.4, 9.11, 9.12, 9.13, 9.17, 9.21,20.1, 20.4, 20.5
IV	2	11.4-11.16
V	3	Chapters 14 & 15

Books For Reference

1. Kenneth S. Krane – Introductory Nuclear Physics, John Wiley and Sons, New York, 1988.
2. Joshi A.W – Nuclear Physics , Gujarat Umesh Prahasham
3. Pandya and Yadav – Nuclear and Particle Physics world, Cambridge University Press
4. Bernard L. Cohen – Concepts of Nuclear Physics, Tata McGraw Hill Publishing Co., New Delhi.
5. Irwing Kaplan, Nuclear Physics, Addison-Wesley Pub. Company, 2nd edition.

Semester – IV Hours / Week : 6
10 PPH 4113 Credit : 5

CONDENSED MATTER PHYSICS

Objectives

- *To study the crystal packing and imperfections*
- *To study Lattice vibration, diffusion, and thermal properties.*
- *To study conductor, super conductor and semiconductor*

Unit I: CRYSTAL PHYSICS AND DEFECTS IN CRYSTALS (15 Hrs)

Close packing of equal spheres in 3D – Classification of close packings– Axial ratio and Lattice constants – Voids – Size, Coordination and Significance – Packing of unequal spheres in 3D – Representation of close packings – Pauling's rule – applications to actual structures – Interpretation of Bragg's equation – Ewald construction – Reciprocal lattice – Point imperfection – Line imperfection – Surface imperfection-color centers

Unit II: LATTICE VIBRATIONS AND ATOMIC DIFFUSION (15 Hrs)

Dynamics of chain of identical atoms and diatomic linear chain – Dynamics of identical atoms in 3D – Experimental measurements of dispersion relation – Anharmonicity and thermal expansion – Atomic diffusion – Diffusion mechanics –

Unit III: ELECTRONIC CONDUCTION IN SOLIDS (15 Hrs)

Effect of temperature on FD function – Electrical conductivity of metals and Ohm's law – Widemann–Franz–Lorentz law – Electrical resistivity of metals –– Nearly free electron model – Tight binding approximation – Fermi surfaces in metals – Characteristics and effect of electric field and magnetic fields of FS – Quantization of electron orbit.

Unit IV: SEMICONDUCTORS (15 Hrs)

Free carrier concentration in semiconductors – Fermi level

and carrier concentration – Mobility of charge carriers – Effect of temperature on mobility – Electrical conductivity of semiconductors – Hall effect in semiconductors – Junction properties of metal and semiconductor

Unit V: DIELECTRIC PROPERTIES OF SOLIDS (15 Hrs)

Local electric field at an atom – Dielectric constant and its measurement – Polarizability – Electronic and Dipolar polarizability – Piezo, Pyro and Ferro electric properties of crystals – Ferroelectricity – Ferroelectric domain – Ferricelectricity

Book for Study

1. Wahab, M.A.., Solid State Physics, Narosha publication house, New Delhi, 1999.

Books for Reference

1. Charles Kittel., Introduction to Solid State Physics, Fifth edition, John Wiley and sons, New Delhi, 2003.
2. Sexana, B.S and Sexana , P.N., Solid State Physics, Pragati Prakasan, Meerut, 1978.

Semester 4 Hours / Week : 4
10 PPH 4203A Credit : 4

ELECTIVE – III: ADVANCED CONDENSED MATTER PHYSICS

Objectives:

- *To understand and apply the advanced concepts of the condensed matter physics*.

Unit I: LATTICE DYNAMICS AND OPTICAL PROPERTIES OF SOLIDS (12 Hrs)

Interatomic forces and lattice dynamics of simple metals, ionic and covalent crystals. Optical phonons and dielectric constants. Inelastic neutron scattering. Mossbauer effect. Debye-Waller factor. Anharmonicity, thermal expansion and thermal conductivity. Interaction of electrons and phonons with photons. Direct and indirect transitions. Absorption in insulators, Polaritons, one-phonon absorption, optical properties of metals, skin effect and anomalous skin effect.

Unit II: ELECTRON PHONON INTERACTION (12 Hrs)

Interaction of electrons with acoustic and optical phonons, polarons. Superconductivity: manifestations of energy gap. Cooper pairing due to phonons, BCS theory of superconductivity, Ginzsburg-Landau theory and application to Josephson Effect: d-c Josephson Effect, a-c Josephson Effect, macroscopic quantum interference. Vortices and type II superconductors, high temperature superconductivity (elementary)

Unit III: MAGNETIC PROPERTIES OF SOLIDS (12 Hrs)

Fundamentals of quantum theory of Paramagnetism – Paramagnetism of free electrons – Ferro magnetism – Weiss molecular field – Temperature dependence of spontaneous magnetization – Domain theory – Antiferromagnetism – Ferrimagnetisms and Ferrites

Unit IV: THERMAL PROPERTIES OF SOLIDS (12 Hrs)

Specific heat of solids – Einstein's model – Density of states – Debye model – Thermal conductivity of solids (electrons and phonons) – Thermal resistance of solids

Unit V: EXOTIC SOLIDS (12 Hrs)

Structure and symmetries of liquids, liquid crystals and amorphous solids. A periodic solids and quasicrystals; Fibonaccy sequence, Penrose lattices and their extension to 3-dimensions. Special carbon solids; fullernes and tubules; formation and characterization of fullerences and tubles. Single wall and multi-wall carbon tubules. Electronic properties of tubules.

BOOKS FOR STUDY:

1. Wahab, M.A.., Solid State Physics, Narosha publication house, New Delhi, 1999.
2. Verma and Srivastava, Crystallography for Solid State Physics.
3. The Physics of Quasicrystals, Eds. Steiinhardt and Ostulond.
4. Handbook of Nanostructured Materials and Nanotechnology (Vol.1 to 4). Ed. Hari Singh Nalwa.

Semester–IV Hours / Week: 4
10 PPH 4203B Credit : 4

ELECTIVE – III: NANOSCIENCE AND NANO TECHNOLOGY

Objectives:

- *To understand the principles and techniques of Nanoscience.*
- *To apply the Nanoscience techniques.*

UNIT – I Introduction to Nanoscience & Technology (12 Hrs)

Definition – Nanotechnology revolution in the making – Impact on various fields: information technology, medicine and health, materials and manufacturing, Aeronautics and space exploration, space research, environmental and energy, national security, science and education.

UNIT – II Nanofabrication and properties of nano materials (12 Hrs)

Lithography – optical lithography – extreme ultraviolet lithography – x-ray proximity lithography – Electron Beam lithography – scanning probe methods – nanoimprint Properties: Aromaticity – chemical properties – quantum properties – mechanical properties – Thermal properties

UNIT – III Quantum Nano Science and nano photonics (12 Hrs)

Quantum measurement control – quantum electro chemical system – quantum choes – quantum dot – quantum dot materials and their applications. Nano optics – nano photonics nano manipulation – AFM, STM, SPM and SEM manipulation – optimal SEM image for nanomanipulation – SPM as a robot – nano rods.

UNIT – IV MEMS Nanotechnology (12 Hrs)

Top down approach - front end approach - types of GMR – MEMS materials – MEMS processes – MEMS applications. NEMS – applications of NEMS – quantum limit – benefits of nanomachines – nano sensors

UNIT – V Nano Devices (12 Hrs)

Single electron devices – single electron tunneling devices – nano flash – yano memory – resonant tunneling diodes – Rapid single flux quantum logic – molecular electronic switching devices – molecular wires – spin device. Carbon nano tube: structure – types – properties and applications.

Book for Study

1. A Hand book on nanotechnology - A.G. Brecket, 1st Edition 2008, Dominant publishers and distributors, New Delhi.
2. Origin and Development of Nanotechnology – P.K. Sharma, 1st Edition 2008, Vista International Publishing House, New Delhi.
3. Nano Science and nano technology – K.P. Mathur, 1st Edition 2007, Rajat Publications, New Delhi.

Semester – IV Hours/Week : 8
10 PPH 4114 Credits : 5

M.Sc - PHYSICS PRACTICAL – IV

Any 15 of the following

1. Microwaves – Gunn diode
2. Fiber Optics Experiment
3. Study of thin films
4. Al O-Bands
5. Read only memory – Construction /IC study.
6. Read/Write memory – construction /IC study.
7. Microprocessor Programming – III- Code conversion, Array manipulation and lookup table
8. Microprocessor Programming – IV-Display in the microprocessor kit
9. Microprocessor Interfacing – I - waveform generation.
10. Microprocessor Interfacing – II – Voltage/Temperature measurement
11. Op.Amp – Solving first order simultaneous equations
12. Microcontroller – Programming and Interfacing.-III
13. Microcontroller – Programming and Interfacing.-IV
14. Synchronous counter – Design for particular sequence and study of counter IC.
15. Study of Balanced Modulator.
16. Study of Frequency Modulation and Demodulation.
17. Study of Modulation and Demodulation – PAM, PPM, PWM.
18. Study of Pulse code Modulation and Demodulation.
19. Digital Modulation – ASK and FSK
20. Resistivity of Semiconductor

INTER DEPARTMENTAL COURSE - IDC

BIOCHEMISTRY

10PBC2401 APPLIED NUTRITION

10PBC3402 FIRST AID MANAGEMENT

BIOTECHNOLOGY

10PBT2401 BASIC BIOINFORMATICS

10PBT3402 BASIC GENOMICS & PROTEOMICS

CHEMISTRY

10PCH2401 HEALTH CHEMISTRY

10PCH3402 INDUSTRIAL CHEMISTRY

COMMERCE

10PCO2401 FINANCIAL ACCOUNTING FOR MANAGERS

10PCO3402 MANAGEMENT CONCEPTS & ORGANIZATIONAL BEHAVIOR

COMPUTER APPLICATIONS

10PCA2401 INTERNET CONCEPTS

10PCA2402 FOUNDATION OF COMPUTER SCIENCE

10PCA3403 COMPUTER APPLICATIONS FOR SOCIAL SCIENCES

10PCA3404 FUNDAMENTALS OF PROGRAMMING

COMPUTER SCIENCE

10PCS2401A FUNDAMENTALS OF IT

10PCS2401B WEB DESIGN

10PCS3402A FLASH

10PCS3402B DREAM WEAVER

ECONOMICS

10PEC2401 ECONOMICS FOR MANAGERS

10PEC3402 INDIAN ECONOMY

ELECTRONICS

10PEL2401 ELECTRONICS IN COMMUNICATION

10PEL3402 COMPUTER HARDWARE

ENGLISH

10PEN2401 BUSINESS ENGLISH

10PEN3402 INTERVEIW SKILLS AND GROUP DYNAMICS

HISTORY

10PHS2401 PUBLIC ADMINISTRATION

10PHS3402 APPLIED TOURISM

HUMAN RESOURCE MANAGEMENT

10PHR2401 FUNDAMENTALS OF HRM

10PHR3402 PERSONALITY AND SOFT SKILLS DEVELOPMENT

INFORMATION TECHNOLOGY

10PIT2401A FUNDAMENTALS OF IT

10PIT2401B WEB DESIGN

10PIT3402A FLASH

10PIT3402B DREAM WEAVER

MATHEMATICS

10PMA2401 OPERATIONS RESEARCH

10PMA3402 NUMERICAL METHODS

PHYSICS

10PPH2401 MODERN PHOTOGRAPHY

10PPH3402 MEDICAL PHYSICS

PLANT BIOLOGY & PLANT BIOTECHNOLOGY

10PPB2401 NANOBIOTECHNOLOGY

10PPB3402 REMOTE SENSIND AND GIS

TAMIL

10PTA2401 muRg gzpj NjuTj jkpo - 1

10PTA3402 muRg gzpj NjuTj jkpo - 2