UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Postgraduate Degree Courses in MSc -Physics

Outcome Based Curriculum

Programme : Master of Science (PHYSICS)

1. Mission:

• To apply conventional and non-conventional tools to conceive physical phenomenon.
• To apply tools and techniques in the development of materials and products.
• To analyse the plant characteristics and develop new/hybrid plant.
• To conduct research based activities in Physics with special focus on bio-physics, applied physics, optics.
• To establish collaboration with eminent institutes and industries for enhanced learning experiences and teaching-learning process.

2. Vision:

The department envisions establishing the Centre for research and development in research with special application to health science, defense and industry. The mission and vision of the organization help in preparation of strategic plan.

3. Title of the Program (s): a. Master of Science (Physics)

4. Program Educational Objectives:

The program educational objectives (PEO) are the statement that describes the career and professional achievement after the program of studies (graduation/ postgraduation). The PEO s are driven form question no. (ii) of the Mission statement (What is the purpose of organization). The PEOs can be minimum three and maximum five.

PEO1: To have advance knowledge and apply theories and principles of physics/appliedphysics in the domain of industry, research and development.
PEO2: To provide the professional services to industry, research organization, institutes.
PEO3: To provide the professional consultancy and research support for the relevant organization in the domain of super specialization.
PEO4: To opt for higher education, disciplinary & multi-disciplinary research and to be a life-long learner.
PEO5: To provide, value based and ethical leadership in the professional and social life.

5. Program Outcomes:

The program outcomes (PO) are the statement of competencies/ abilities. POs are the statement that describes the knowledge and the abilities the graduate/ post-graduate will have by the end of program studies.

Programme Specific Outcomes:

PSO1: Domain knowledge: Apply the knowledge of mathematics and physics fundamental, Quantum physics, electronics, spectroscopy for the solution of complex problems.

PSO2: Problem Analysis: Identify physics/optics/nuclear physics/ microprocessor/ sensor/ radiation related problems at varied complexity and analyze the same to formulate/ develop substantiated conclusion using first principles.

PSO3: Design Development of solutions : Design / develop solutions for problems at varied complexity in the area Sensor Technology, industrial electronics, Materials, nano-materials, radiation technology Industrial Communication to address changing challenges put forward by market demand/ stakeholder

PSO4: Conduct Investigation of complex problems: Use research-based knowledge and methods to design of experiments, analyze resulting data and interpret the same to provide valid conclusions.

PSO5: Modern tools: Create, select, and apply appropriate techniques, resources, and microprocessor and relevant IT tools including prediction and modeling to complex scientific solutions related activities with clear understanding of the limitations

PSO6: The citizenship and society: Apply broad understanding of ethical and professional skill in scientific applications in the context of global, economic, environmental and societal realities while encompassing relevant contemporary issues.

PSO7: Environment and sustainability: Apply broad understanding of impact of
electronics technology in a global, economic, environmental and societal context and demonstrate the knowledge of, and need for sustainable development.

PSO8: Ethics: Apply ability to develop sustainable practical solutions for electronics technology related problems within positive professional and ethical boundaries.

PSO9: Project management and finance: Demonstrate knowledge and understanding of the first principles of Nano-technology, sensor technology, nuclear physics, radiation, and spectroscopy and apply these to one's own work as a member and leader in a team, to complete project in any environment.

PSO10: Life-long learning: Recognize the need for lifelong learning and have the ability to engage in independent and life-long learning in the broadest context of technological change.

6. Course- Program outcome Matrix:

The Program Outcomes are developed through the curriculum (curricular/co-curricularextra-curricular activities). The program outcomes are attained through the course implementation. As an educator, one must know, "to which POs his/her course in contributing?". So that one can

design the learning experiences, select teaching method and design the tool for assessment. Hence, establishing the Corse-PO matrix is essential step in the OBE. The course-program outcomes matrix indicates the co-relation between the courses and program outcomes. The CO-PO matrix is the map of list of courses
contributing to the development of respective POs.

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

(06) Programme PO's and PSO's Mapping

			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2
S. No	**Program**	**Courses Category**	Problem Analysis	Design/Development of Solution	Investigation	Modern Tool Usage	Environment and Sustainability	Ethics	Individual and Team Work	Project Management	Life-Long Learning		
1	**MSc Physics**	Humanities and Social Sciences including Management courses	*			*		*			*	*	
2		Basic Science courses	*	*	*	*	*						*
3		Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.											
4		Professional core courses	*	*	*							*	
5		Professional Elective courses relevant to chosen specialization/branch	*	*	*	*		*	*				*

6		Open subjects – Electives from other technical and /or emerging *subjects	*	*	*	*	*	*	*		*	*	*
7		Project work, seminar and internship in industry or elsewhere	*	*	*		*	*	*	*	*		*
8		Specific core subject	*	*	*								
9		Mandatory Course (Non credit)					*	*	*		*		

(07) Semester wise PO's and SPO's Mapping

Sem	Name of the Courses/POs /Basic,	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2
	Core Electives, Projects, Internships etc.)	**Problem Analysis**	**Design/Development of Solution**	**Investigation**	**Modern Tool Usage**	**Environment and Sustainability**	**Ethics**	**Individual and Team Work**	**Project Management**	**Life-Long Learning**		
Sem I	MATHEMATICAL PHYSICS	*	*	*	*			*	*	*	*	
	CLASSICAL MECHANICS	*	*	*						*		

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

	QUANTUM MECHANICS	*	*	*	*		*			*		*
	ELECTRONIC DEVICE	*	*	*	*						*	
Sem II	QUANTUM MECHANICS II	*	*	*						*		*
	STATISTICALMECHANICS	*	*	*								
	ELETRO DYNAMICS AND PLASMA PHY.										*	
	ATOMIC AND MOLECULAR PHYSICS	*	*	*								
Sem III	Condensed Matter	*	*	*								
	Nuclear and Particle	*	*								*	
	Digital Electronics	*	*									
	Atomic and Molecular	*	*									*
Sem IV	Condensed Matter Physics II					*		*			*	
	LASER PHYSICS	*									*	

	COMPUTER PROGRAMMING AND INFORMATICS	*	*									*
	DIGITAL ELECTRONICS	*	*	*							*	

(08) Structure of Programme: To fulfill the need of development of all the POs/ GAs, as per above mapping, the following semester wise programme structure are as under.

[L= Lecture, T = Tutorials, P = Practical's & C = Credits]

Total Hrs.*= 160 Hrs.

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

Structure of MSc program:

S. No.	Course Category	Hours of the MSc Chemistry Curriculum
1.	MATHEMATICAL PHYSICS	11
2.	CLASSICAL MECHANICS	24
3.	QUANTUM MECHANICS	19
4.	ELECTRONIC DEVICE	20
5.	QUANTUM MECHANICS II	18
6.	STATISTICAL MECHANICS	18
7.	ELETRO DYNAMICS AND PLASMA PHY.	18
8.	ATOMIC AND MOLECULAR PHYSICS	24
9.	Condensed Matter	19
10.	Nuclear and Particle	18
11.	Digital Electronics	18
12.	Atomic and Molecular	18
13.	Condensed Matter Physics II	18
14.	LASER PHYSICS	24
15.	COMPUTER PROGRAMMING AND INFORMATICS	19
16.	DIGITAL ELECTRONICS	
	Total	

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

***Definition of Credit:**

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (Lab)/week	1 Credit

Programme Structure: The M.Sc. Microbiology programme is a two-year course divided into four-semesters. A student is required to complete ninety-six credits for the completion of course and the award of degree. A student has to accumulate twenty-four credits in each of the four semesters.

Part – I	**First Year**	**Semester I**	**Semester II**
Part -II	**Second Year**	**Semester III**	**Semester IV**

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

Scheme of Examination

I Semester

M.SC PHYSICS FIRST SEMESTER												
SUBJECT CODE	COMPULSORY / OPTIONAL	SUBJECT NAME	THEORY						PRACTICAL		TOTAL	
			PAPER		CCE / INTERNAL		TOTAL MARKS		MAX	MIN	MAX	MIN
			MAX	MIN	MAX	MIN	MAX	MIN				
PHY-101	COMPULSORY	MATHEMATICAL PHYSICS	70	25	30	10	100	35	0	0	100	35
PHY-102	COMPULSORY	CLASSICAL MECHANICS	70	25	30	10	100	35	0	0	100	35
PHY-103	COMPULSORY	QUANTUM MECHANICS	70	25	30	10	100	35	0	0	100	35
PHY-104	COMPULSORY	ELECTRONIC DEVICE	70	25	30	10	100	35	0	0	100	35
PRACTICAL												
PHY - 105	COMPULSORY	GENRAL LAB	0	0	0	0	0	0	50	18	50	18
PHY - 106	COMPULSORY	ELECTRONIC LAB	0	0	0	0	0	0	50	18	50	18

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

SECOND SEMESTER

SUBJECT CODE	SUBJECT NAME	THEORY		CCE / INTERNAL		PRACTICAL		Total	
		MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
PHY201	QUANTUM MECHANICS II	70	25	30	11	-	-	100	36
PHY202	STATISTICAL MECHANICS	70	25	30	11	-	-	100	36
PHY203	ELETRO DYNAMICS AND PLASMA PHY.	70	25	30	11	-	-	100	36
PHY204	ATOMIC AND MOLECULAR PHYSICS	70	25	30	11	-	-	100	36
	PRACTICAL								
PHY205	PRACTICAL I - GENERAL PHYSICS BASED	-	-	-	-	50	18	50	18
PHY206	PRACTICAL II - ELECTRONICS BASED	-	-	-	-	50	18	50	18

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

Third Semester

SUBJECT CODE	COMPULSORY/ OPTIONAL	SUBJECT NAME	THEORY						PRACTICAL		TOTAL	
			PAPER		CCE / INTERNAL		TOTAL MARKS		MAX	MIN	MAX	MIN
			MAX	MIN	MAX	MIN	MAX	MIN				
PHY301	COMPULSORY	Condensed Matter	70	28	30	10	100	38	0	0	100	38
PHY302	COMPULSORY	Nuclear and Particle	70	28	30	10	100	38	0	0	100	38
PHY303	COMPULSORY	Digital Electronics	70	28	30	10	100	38	0	0	100	38
PHY304	COMPULSORY	Atomic and Molecular	70	28	30	10	100	38	0	0	100	38
PHY305	COMPULSORY	LAB A	0	0	0	0	0	0	50	18	50	18
PHY306	COMPULSORY	**LAB B**	0	0	0	0	0	0	50	18	50	18
PHY307	COMPULSORY	**INTERNSHIP**	0	0	0	0	0	0	100	36	100	36

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

Fourth- Semester

Code	Subject	CCE/INTERNAL		Theory		Practical		Total	
		Max	Min	Max	Min	Max	Min	Max	Min
PHY401	Condensed Matter Physics II	30	11	70	25	-	-	100	36
PHY402	LASER PHYSICS	30	11	70	25	-	-	100	36
PHY403	COMPUTER PROGRAMMING AND INFORMATICS	30	11	70	25	-	-	100	36
PHY404	DIGITAL ELECTRONICS	30	11	70	25	-	-	100	36
PHY405	LAB A- GENERAL	-	-	-	-	50	18	50	18
PHY406	LAB B- ELECTRONIC	-	-	-	-	50	18	50	18

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

Semester-I

Paper-I: Mathematical Physics

PHY-101	Mathematical Physics	3L:0T:1P	36 Hrs	3Hrs/Week

U NIT– I **6 Hrs.**

Differential equations ; Recursion relation, generating functions and orthogonality of Bessel functions of first and second kind , Hermite , Legendre, Associate Legendre and Laguerre Polynomials, Curvlinier co-ordinate system with specific cases of Cartesian, Cylindrical ,and Spherical coordinate system.

UNIT– II **6 Hrs.**

Integral transform , Fourier intrgral , Fourier transform and inverse fourier transforms, Fourier transform of derivatives , Convolution theorem . Elementry Laplace transforms. Laplace transform of derivatives , Convolution theorem , Elementry Laplace transforms. Laplace transform of derivatives. Application to a damped harmonic oscillator.

UNIT – III **6 Hrs.**

Green,s function : non –homogeneous boundary value problems , Green's function for one dimensional problem , eigen function expansion of Green,s function , Fourier transform,method of constructing Green's function , Green's function for electrostatic boundary valueproblem and quantum – mechanical scattering problem.

UNIT – IV **6 Hrs.**

Complex variables : Analyticity of complex functions. Caushy Riemann equations. Cauachy theorem . Cauchy integral formula. Taylors, Maclaurin , Laurent series and mapping. Theorem of residues. Simple cases of contour integration. Jordan's lemma Integrals involving multiple valued functions (Branch point).

UNIT –V **6 Hrs.**

This unit will have a short note question covering all the four units . 'The studens we have *to* answer any two questions out of the four.

REFRENC E BOOKS :

H.K. DAS MATHEMATICAL PHYSICS
GHATAK , GOYAL & GUHA MATHEMATICAL PHYSICS
ARFKEN MATHEMATICAL METHODES FOR PHYSICSTS

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

Semester-I

Paper-II: CLASSICAL MECHANICS

PHY-102	**CLASSICAL MECHANICS**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

Unit-I 6 Hrs.

Newton in mechanics of one and many particles systems: Conservation laws, Constrains their classification, Principle of virtual work; D'Almbert's Principle in generalized coordinates, The Lagrange's equation from D'Almbert's principle. Configuration space, Hamilton's principle deduction from D'Almberts principle, Generalized momenta and Lagrangian formulation of the conservation theorems, Reduction to the equivalent one body problem; the equation of motion and first integrals, the differential equation for the orbit.

UNIT-II **6 Hrs.**

The equations of canonical,transformation and generating functions; The Hamilton-Jacobi Action and Angel variables. Poisson's brackets; simple algebraic properties of Poisson's brackets. The equation of motion in Poisson's Brackets notation. Poisson theorem; principle of least action. The Kepler problem, Inverse central force field, Rutherford scattering.

UNIT-III **6 Hrs.**

Theory of small oscillations, Equations of motion, Eigen frequencies and general motion, normal modes and coordinates, Applications to coupled pendulum and linear bistable molecule. Rotating coordinate systems. Acceleration in rotating frames. Coriolis force and its terrestrial astronomical applications, Elementary treatment of Eulerian coordinates and transformation matrices. Angular momentum inertia tensor. Eular equations of motion for a rigid body. Torque free motion for a rigid body.

UNIT-IV **6 Hrs.**

Symmetries of space and time. Invariance under gali lion transformation, Covariant four-dimensional formulation, 4 -Vectors and 4 - scalers. Relativistic generalization of Newton's laws, 4- momentum and 4- force, variance under Lornetz transformation relativistic mechanics. Covariant Lagrangian, covariant Hamiltonian, Examples.

UNIT –V **6 Hrs.**

This unit will have a short note *question covering all the tour units. The students will have to answer any two questions out of the four.

REFRENCE BOOKS:

H. GOLDSTEIN(ADDISON WESLEY) CALASSICAL MECHANICS

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

Semester-I

Quantum Mechanics- I

PHY-103	**Quantum Mechanics- I**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

Unit - I 6 Hrs.

Basic Postulates of quantum Mechanics, equation of continuity, Normality, orthogonality and closure properties of eigen functions, expectation values and Ethrentest theorems, solution of Schrodinger equation for one dimensional (a) potential well (b) potential step and (c) Potential barrier.

Unit-II **6 Hrs.**

Linear vector space, concept of Hibert space, bra and ket notation for state vector, representation of state vectors and dynamical variables by matrices and unitary transformation (Translation and rotation), creation and annihilation operators, matrices for x and p. Heisenberg uncertainty relation through operators (Schwartz inequality).

Unit-III **6 Hrs.**

Solution of Schrodinger equation for (a) linear harmonic oscillator (b) hydrogen -like atom (c) square well potential and their respective application to atomic spectra, molecular spectra and low energy nuclear states (deutron).

Unit-IV **6 Hrs.**

Angular momentum in quantum mechanics, Eigen values and Eigen function of L^2 and 1,, in term of spherical harmonics, commutation relation. Time independent perturbation theory. Non-degenerate and degenerate cases.

Unit-V **6 Hrs.**

This unit will have a short note question covering all the four units. The students will have to answer any two questions out of the four.

REFRENCE BOOKS:

L . I. SCHIFF QUANTUM MECHANICS

S GASIOROVVICZ QUANTUM MACHANICS

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

Semester-I

Paper : C- PROGRAMMING AND NUMERICAL METHODS

PHY-104	**C- PROGRAMMING AND NUMERICAL METHODS**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

Unit – I **6 Hrs.**

Transistors: JFET, BJT, MOSFET and MESFET, structure derivations of the equations for 1-V characteristics under different conditiOn, microwave devices, tunnel diode, transfer electron devices (Gunn diode), avalanche transits time devices, Impatt diodes and parametric devices.

UNIT - II **6 Hrs.**

Photonic devices: radiative and non-radiative transitions, optical absorption, bulk and. thin fin photo conductive devices (LDR), diode Photo detectors, Solar cell (open circuit voltage an(short circuit current, fill factor), LED (high frequency limit, effect of surface and indirec recombination current, operation of LED), semi-conductors; diode lasers (conditions 'fo population inversion in active region, light confinement factor, optical gain and thresholi current for lasing.

UNIT - III **6 Hrs.**

Memory Devices: Read Only Memory (ROM) and Random Access Memory(RAM).Types o .ROM: PROM, EPROM, EEPROM and EAPROM, Static and dynamic RAMs (SRAM 6 DRAM), characteristics of SRAM and DRAM.Hybrid. Memories: CMOS and NMOS memorie Nonvolatile RAM, ferro-electric memories, charge coupled devices (CCD), storag devices: Geometry and organization of magnetic (FDD & HDD) and Optical (CD-ROM CD-R, CD-R/W, DVD) Storage devices.

UNIT- IV **6 Hrs.**

Electro-o2tics, Magneto-optic and Acousto-optic effects, materials properties related to gel these effectimportant ferro electric, liquid crystal and polymeric materials for these devices: piezoelectric, electrostrictive and magnetostrictive effects. Important materials for these properties and their appliCations in sensors and actuator devices, acoustic delay lines, piezoelectric resonators and filters, high frequency piezoelectric devices-surface, acoustic wave devices,

UNIT -V **6 Hrs.**

This unit will have a short note question covering all the four units . 'The students will have *to* answer any two questions out of the four.

REFRENCE BOOKS :

SM SZE WILLEY(1985) SEMICONDUCTOR DEVICES –PHYSICS TECHNOLOGY

MS TYAGI INTRODUCTION TO SEMICONDUCTORS DEVICES

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

Semester-II

Paper: QUANTUM MECHANICS II

PHY201	**QUANTUM MECHANICS II**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

Unit-1 **6 Hrs.**

Approximation method for bound states : Rayleigh- Schrodinger Perturbation theory of non-degenrate and degenrate levels and their application to perturbation of an oscillator, normal helium atom and first order stark effect in hydrogen. Variation method and its application to ground state helium, W K B Approximation method, connection formulae, ideas on potential barrier with applications to theory of alpha decay.

Unit–2 **6 Hrs.**

Time dependant perturbation theory: Methods of variation of constants and transition probability, adiabatic and sudden approximation, wave equation for a system of charged particles under the influence of external electromagnetic field, absorption and induced emission, Einstein's A and coefficients and transition probability.

Unit-3 **6 Hrs.**

Theory of Scattering, Physical concepts, scattering amplitude, scattering cross section. Born Approximation and partial waves, scattering by perfectly rigid sphere, complex potential and absorption, scattering by spherically symmetric potential, identical particles with spin, Pauli's spin matrices

Unit-4 **6 Hrs.**

Schrodinger's relativistic equation (Klein-Gordon equation), Probability and current density, Klein - Gordon equation in presence of electromagnetic field, hydrogen atom, short comings of Klein-Gordo equation, Dirac's relativistic equation for free electron, Dirac's Matrices. Dirac's relativistic equation in electromagnetic field, negative energy states and their interpretation hydrogen atom, hyperfine splitting.

Unit-5 **6 Hrs.**

This unit will have a short note question covering all the four units. The students will have to answer any two questions out of the four.

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

Paper - STATISTICAL MECHANICS

PHY202	**STATISTICAL MECHANICS**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

Unit-1 **6 Hrs.**

Foundation of statistical mechanics, specification of states of a system contact between statistics and thermodynamics, classical ideal gas entropy of mixing and Gibb's paradox.Microcanonical ensemble, phase space, trajectories and density of states, Liouville theorem, canonical and grand canonical ensembles, partition function, calculation of statistical quantities, energy and density fluctuations.

Unit–2 **6 Hrs.**

Statistics of ensembles, statistics of indistinguishable particles, density matrix, Maxwell -- Boltzmann, Fermi Dirac and Bose- Einstein statistics, properties of ideal Bose gases, Bose — Einstein condensation, properties of ideal Fermi gas, electron gas in metals, Boltzman transport equation.

Unit-3 **6 Hrs.**

Cluster expansion for a classical gas, virial equation of state, mean field theory of Ising model in 3,2 and 1 dimension. Exact solution in one-dimension.

Unit-4 **6 Hrs.**

Thermodynamics fluctuation spatial correlation Brownian motion, Langevin theory, fluctuation dissipation theorem, the Fokker-Planck equation, Onsager reciprocity relations.

Unit-5 **6 Hrs.**

This unit will have a short note, question covering all the four units. The students will have to answer any two questions out of the four.

Books Recommended:-

1. F Reif Statistical and thermal Physics
2. K Huang Statistical Mechanics
3. R K Pathria Statistical Mechanics

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

Paper: ELECTRODYNAMICS AND PLASMA PHYSICS

PHY203	**ELECTRODYNAMICS AND PLASMA PHYSICS**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

Unit-1 **6 Hrs.**

Review of Basics ofelectrostatics and magnetostatics (electric field, Gauss's law, Laplaces and Poisson equations, method of images, Biot-Sawart law, Ampere law, Maxwell's equations, scalar and vector potentials, gauge transformation, Lorentz gauge, Coulomb Gauge, Solution of Maxwell equations in conducting media radiations by moving charges, retarded potentials, Lienard Wiechrt potentials, fields of charged particles in uniform motion, fields of arbitrarily moving charge particle.

Unit–2 **6 Hrs.**

Fields of an accelerated charged particles at low velocity and high velocity, angular distribution of power radiated, Review of four vector and Lorentz transformation in 4- dimensional spaces, Invariance of electric charge,relativistic transformation properties of E and H fields. Electromagnetic fields tensor in 4-dimensional Maxwell equation, Four Vector current and potential and their invariance under Lorentz transformation, covariance of electrodynamics. Langragian and Hamiltonian for a relativistic charged particle jn External EM field; motion.of charged particles in electromagnetic fields, uniform and non-uniform E and B fields.

Unit-3 **6 Hrs.**

Elementary concept of occurrence of plasma, Gaseous and solid state plasma. Production of gaseous and solid state plasma. Plasma parameters. Plasma confinement pinch effect instability in a pinched- plasma column. Electrical neutrality in a plasma. Debye screening distance. Plasma oscillations: Transverse oscillations and longitudinal oscillations.

Unit-4 **6 Hrs.**

Thermodynamics fluctuation spatial correlation Brownian motion, Langevin theory, fluctuation dissipation theorem, the Fokker-Planck equation, Onsager reciprocity relations. Domain of Magnetohydrodynamics and plasma Physics : Magneto-hydrodynamic equations, magnetic

hydro-static pressure hydrodynamic waves: Magneto-sonic and Alfven waves, particle orbits and drift motion in a plasmas, Experimental study of Plasma, the theory of single and double probes.

Unit-5 **6 Hrs.**

This unit will have a short note, question covering all the four units. The students will have to answer any two questions out of the four.

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

Paper: ATOMIC AND MOLECULAR PHYSICS

PHY204	**ATOMIC AND MOLECULAR PHYSICS**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

Unit-1 **6 Hrs.**

Review of Basics ofelectrostatics and magnetostatics (electric field, Gauss's law, Laplaces and Poisson equations, method of images, Biot-Sawart law, Ampere law, Maxwell's equations, scalar and vector potentials, gauge transformation, Lorentz gauge, Coulomb Gauge, Solution of Maxwell equations in conducting media radiations by moving charges, retarded potentials, Lienard Wiechrt potentials, fields of charged particles in uniform motion, fields of arbitrarily moving charge particle. Quantum states of one electron atom. Atomic orbitals. Hydrogen spectrum, Paulis principle, Spectra of alkali elements, Spin orbit interaction and line structure of alkali Spectra . Methods of molecular quantum mechanics, Thomas Fermi statistical model, Hartree and Hartree fock method, Two electron system. Interaction energy in L-S and J-J coupling, hyperfine structure (qualitative), line broadening mechanisms(general ideas).

Unit–2 **6 Hrs.**

Types of molecules. Diatomic linear. Symmetric top, asymmetric top and spherical top molecules. Rotational spectra of diatomic molecules as a rigid rotator, Energy level and Spectra of non-rigid rotator, intensity of rotational lines,

Unit-3 **6 Hrs.**

Vibrational energy of diatomic molecule, diatomic molecule as a simple harmonic oscillator, Energy levels and spectrum, Morse potential energy curve, Molecules as vibrating rotator, Vibration spectrum, of diatomic molecule PQR branches, IR spectrometer(qualitative)

Unit-4 **6 Hrs.**

Introduction to ultraviolet, visible and infra-red spectroscopy, Raman spectroscopy: Introduction, pure rotational and vibrational spectra, Techniques and instrumentation, Photo electron

spectroscopy, elementary idea about photoacoustic spectroscopy and Mossbauer spectroscopy(principle).

Unit-5 **6 Hrs.**

This unit will have a short note question covering all the four units. The students will have.

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

Third Semester

Paper- Condensed Matter

PHY301	Condensed Matter	3L:0T:1P	36 Hrs	3Hrs/Week

UNIT-I **6 Hrs.**

Crystal structure: Bravais lattice in two and three dimension. Simple crystal structures: Hexagonal close packed structure, Iliamond structure, zinc blende structure, sodium chloride structure, cesium chloride structure.

UNIT-II **6 Hrs.**

Crystal diffraction by X-Ray: Reciprocal lattice, Reciprocal lattice of bcc and fcc lattice. Relation between crystal lattice axes and crystal reciprocal lattice axes. Bragg diffraction. Condition in term of reciprocal lattice vector. Brillouin zones.

UNIT-III **6 Hrs.**

Elastic properties of solids: Stress and strain components, elastic compliance and stiffness constants, elastic energy density, reduction of number of elastic constants, elastic stiffness constants for isotropic body, elastic constant for cubic isotropic bodies, elastic waves, waves in (100) direction, experimental determination of elastic constants.

UNIT-IV **6 Hrs.**

Lattice vibration and phonons: Lattice dynamic of a diatomic linear lattice. Lattice vibrational spectrum. The concept of phonons momentum of phonons. Inelastic scattering of photons by phonons. Inelastic scattering of neutrons by phonons. Inelastic scattering of X-Ray.

UNIT-V **6 Hrs.**

Thermal properties and band theory of solids: Anharmonicity, thermal expansion, thermal conductivity, equation of state of solids, gruneisen constant. Band theory, classification of solids, concepts of effective mass. Fermi surfaces, anomalous skin effect, De Hass van alphen effect, cyclotron resonance, magneto resistance.

Suggested Readings :

1. Velma and Srivastava: Crystallography for solid State physics.
2. Azaroff: Elementary to Solids.
3. Omar: Introduction Solids state physics.
4. Kittle: Solids state physics

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

Paper- Nuclear and Particle

PHY302	Nuclear and Particle	3L:0T:1P	36 Hrs	3Hrs/Week

UNIT-I **6 Hrs.**

Nuclear Interaction and Nuclear reaction: Nuclear forces, exchange and tensor forces, meson theory of nuclear forces, Low-energy n-p scattering and spin dependence of n=4) forces. Direct and compound nuclear reaction mechanism, reciprocity4heorem.

UNIT-II **6 Hrs.**

Accelerators of charged particles: Study of cyclotron, phase stability, frequency modulated cyclotron (synchorocyclotron) magnetic induction accelerator (Betatron), Electron synchrotron and linear accelerator (Linac)

UNIT-III **6 Hrs.**

Nuclear models: Liquid drop model, Bohr-wheeler's theory of nuclear fission, shell model, spin orbit interaction, magic number, spin and angular momenta of nuclear ground state, nuclear quadrupole moment.

UNIT-IV **6 Hrs.**

Nuclear decay and elementary particles: p Decay, general features of i ray spectrum, Fermi theory of p decay, selection rules, parity in /3 decay, multipole radiation, internal conversion, nuclear isomerism.

UNIT-V **6 Hrs.**

Elementary particles: Classification of elementary particles, fundamental interaction, parameters of elementary particles. Symmetry and conservation laws, symmetry schemes of elementary particles SU(3)

Suggested Readings :

1. Introduction to Nuclear physics : H.A. Enge
2. Nuclear radiation detectors : S.S. Kapoor and V.S.Ramamurthy
3. Atomic and Nuclear physics : S.N. Ghoshal

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

Paper - Digital Electronics

PHY303	Digital Electronics	3L:0T:1P	36 Hrs	3Hrs/Week

UNIT-I **6 Hrs.**

Number system (Binary, Octal, Decimal, hexadecimal) and conversion between them. Boolean arithmetic, signed and unsjigned binary numbers, I's complement, 2's complement,

UNIT-II **6 Hrs.**

Codes: BCD, Gray, ASCII, EBCDIC, Demorgans theorem, Gates: OR, AND, NOT, NOR, OR, NAND, XOR, XNOR, Boolean algetra, karnaugh map, adder and subtractor circuit design.

UNIT-III **6 Hrs.**

Multiplexer, demultiplexer, encoder, decoder, parity checker and generator, Flip-Flops: R-S,D, J-k, J-k Master slave flip flop, race around condition registers, shift registers (left and right shift)

UNIT-IV **6 Hrs.**

Counters-asynchronous (ripple) counter, synchronous (parallel) counter, MOD-5 counter and MOD-10 counter, BCD counter, Up-Down counter, Shift Register counter (Ring counter)

UNIT-V **6 Hrs.**

Digital to analog conversion (Binary weighted register method, R-2R ladder network method, complete DAC structure. Analog to digital converters (Stair case or counter method, single slope, equal slope, successive approximation ADC)

Suggested Readings :

1. "Digital principles and applications" by A.P.Malvino and Donald P.Leach, Tata Megraw-Hill company, New Delhi, 1993.
2. "Microprocessor Architecutre, Programming and Applications with 8085/8086 by Rames S. Gaonkar, Wiley-eastern Ltd. 1987 (for unit V)"
3. Digital electronics —S.N. Ali

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

Paper- Atomic and Molecular

PHY304	Atomic and Molecular	3L:0T:1P	36 Hrs	3Hrs/Week

UNIT-I **6 Hrs.**

Nuclear Magnetic Resonance SpectrCiscopy: Concept of Nuclear Magnetic resonance spectroscopy, Interaction between nuclear spin and magnetic field, population of energy level, relaxation processes, spin-spin interaction and spin-spin coupling between two and more nuclei (Qualitative)

UNIT-II **6 Hrs.**

Electronic spectra of Diatomic Molecules: Franck Condon principles, dissociation and pre-dissociation, dissociation energy. Born-Oppenheimer-approximation, vibrational coarse structure of electronic spectra (bands progression and sequence).

UNIT-III **6 Hrs.**

Raman Spectra Raman effect, quantum theory of Raman effect, Molecular polarisibility in Raman effect, Vibrational Raman spectra, vibration-rotation Raman Spectra of diatomic molecules, application of Raman and infrared spectroscopy in the structure determination.

UNIT-IV **6 Hrs.**

Mossbauer Spectroscopy: Mossbauer effect, principles of Mossbauer spectroscopy, recoil less emission of gamma emission, line width and resonance absorption, application of mossbauer spectroscopy (Isomer shift, Quadra pole splitting magnetic field effect).

UNIT-V **6 Hrs.**

Electron Spin Resonance spectroscopy: Elementary Idea about ESR, Principle of ESR, ESR spectrometer, splinting of electron energy levels by a magnetic field, G-Values, simple experimental setup of ESR. ESR s sectra of free radicals in solution, An Isotropic system.

Suggested Readings :

1. Fundamentals of Molecular Spectroscopy-C.B. Banwell.
2. Spectra of Diatomic Molecules-Herzberg.
3. Mossbauer Spectroscopy-M.R.Bhide

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

IV- Semester

Condensed Matter Physics II

PHY401	**Condensed Matter Physics II**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

UNIT-I **6 Hrs.**

SUPER CONDUCTIVITY : Concept of super conducting state, Persistent current, Critical temperature , Meissner effect,THERMODYNAMICS OF THE SUPERT CONDUCTING TRANSITIONS, London equation and penetration depth ,Coherence length, Type I and Type II superconductors , B.S.C. theory of superconductivity. AC and DC Josephson effects, Josephson Tunneling.

UNIT-II **6 Hrs.**

MAGNETISM : Weiss theory of ferromagnetic Heisenberg model and molecular field theory, Domain and Bloch wall energy , Spin waves and mangnons,curie waiss law for susceptibility, Ferri and anti ferromagnetic.

UNIT-III **6 Hrs.**

IMPERFECTION IN CRYSTALS : Imperfection in atomic packing , point defects , interstitial Schottkey and Frenkel defects, lattice vacancies colour centres, F centers ,F' centers, coagulation of F centers,production of colour centers and V centers, explanation of experimental facts , line defects, edge and screw dislocation, mechanism of plastic deformation , elastic energy of dislocation, slip and plastic deformation, shear strength of single ceystal, brrgers vector stress fields around dislocation.

UNIT-IV **6 Hrs.**

THIN FILM: Study of surface topography by multiple beam interferometer, conditions for accurate determination of step height and film thickness (Fizeau frings) , Electrical conductivity

of thin films, expression for electrical conductivity opf thin films, Hall-coeffient quantum size effect in thin film.

UNIT-V **6 Hrs.**

NANO STRUCTURE:

Definition and properties of nano structured material,different method of preparation of nano materials, plasma enhanced chemical vapour deposition , electro deposition. Structure of single wall carbon nano tubes (classification, chiral vector Cn, Translational vector T. Symmetry vector R ,Unit cell, Brillouin Zone) Electronic , mechanical, thermal and phonon properties

Suggested Readings:

- Kittel : Solid State physics
- Huang : Theoretical solid state physics
- Thomes : Multiple electron microscopy

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

PHY402- LASER PHYSICS

PHY402	LASER PHYSICS	3L:0T:1P	36 Hrs	3Hrs/Week

UNIT-I **6 Hrs.**

Basic principles of LASER : Introduction to LASER , Spontaneous and Stimulated emission. Einstein coefficients. Idea of light amplification. Population inversion , laser pumping schemes for two and three level system with threshold condition for laser oscillation.

UNIT-II **6 Hrs.**

Properties of Laser Beams and Resonators: Properties of Laser-Temporal coherence , spatial coherence, directionality and monochromatic of laser beam, resonators, vibrational mode of resonators, laser amplification, open resonator.

UNIT-III **6 Hrs.**

Types of lasers : Solid state lasers i.e. Ruby Laser, ND-Yag Laser, Semiconductor laser, Gas laser i.e. Carbon dioxide Laser, Basic idea about liquid laser, Dye laser and chemical laser i.e. HCL and HF lasers.

UNIT-IV **6 Hrs.**

Application of lasers Holography and principle, theory of holograms, reconstruction of Image, characteristics of Holographs, Application of lasers in chemistry and optics laser in Industry i.e. laser Belding, Hole drilling, laser cutting, application of lasers in Medicine.

UNIT-V **6 Hrs.**

Basic idea about non-linear optics: Harmonic generation, second and third harmonic generation , phase matching, optical mixing, parametric generation of light , self-focusing of light.

Suggested Readings:

- Laser : Syelto
- Optical electronics : Yarive
- Non linear optics : B.B. Loud

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

COMPUTER PROGRAMMING AND INFORMATICS

PHY403	**COMPUTER PROGRAMMING AND INFORMATICS**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

UNIT-I **6 Hrs.**

Conceptual framework of computer languages (Algorithm, Flowchart) ,Need of structured programming , Top-down, bottom-up and modular programming design. Introduction to C languages –basic structure of C program. Character set, keyword and identifiers, relational, logical, assignment, conditional, increment and decrement operators. Evaluation of expression and operator precedence.

UNIT-II **6 Hrs.**

Input and output statement, control statement (IF,IF-else, If nested if-else statements, switch ,while , Do….while and for statements) Simple C programs like search of prime number between given range of numbers, finding the smallest and largest of three numbers, sum of algebraic series, factorial of given number, roots of a quadratic equation , binary to decimal and decimal to binary conversion etc.

UNIT-III **6 Hrs.**

Functions: need of functions, calling the function by value and by reference, category of function: no argument no return, argument but not return , argument with return. Recursion. One and two dimensional arrays. String and string handling functions like sprint (), strcpy () , sscanf () , strcmp() etc . Simple programs using user define functions, arrays and string functions.

UNIT-IV **6 Hrs.**

Network: Terminals- Dumb terminals , smart terminals, intelligent terminals.

Types of network: * According to range: LAN, MAN, WAN, CLIENT SERVER.

*According to topologies : BUS, RING, STAR, Mesh Network. INTERNET : History of Internet , Service Provider (ISP) , introduction to type of internet accountshell/Ac, TCP/IP A/C.

Types of connectivity- Dialup, Leased lines, Satellite. IP Address-Class A, Class B, Class C , Domain Name address. URL- absolute and relative.

UNIT-V **6 Hrs.**

Web enabled technology (Email and HTML) : Web Browser: Internet Explorer, Netscape Navigator , Station and Dynamic web page. Introduction to HTML Tags :

- <HTML> , <TITLE> ,<HEAD> ,<BODY>
- <P> ,
 , <ALIGN> , <I>, <B> , <DIV> , <PRE> , and their attributes.
- <IMG> , <a> ,and their attributes.
- Ordered and Unordered list tages.
- Tabes and associated tages and its properties.Creation of simple forms using text, Password , text area , radio, submit, Reset and Hidden. Brief idea about HTTP . Search engine , its working , types of working , types of search engines : sub directories

Suggested Readings:

Let us C : Yashwant Kanetkar

Programming with C : Balaguruswami

Internet and Web page ‘o’ level module M1.2 : V.K. Jain

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Physics

DIGITAL ELECTRONICS

PHY404	DIGITAL ELECTRONICS	3L:0T:1P	36 Hrs	3Hrs/Week

UNIT-I **6 Hrs.**

OP-AMP: Differential amplifier circuit configurations : dual input balanced output dual input , single input unbalanced output (AC analysis) , symbol of an op-amp .

UNIT-II **6 Hrs.**

OP-AMP PARAMETER: Ideal op-amp , Op-amp parameters , input offset voltage , input offset current , input bias current , CMRR , SVRR , large signal voltage gain , Slew rate , Gain band width product , output resistance , supply currents power consumption , inverting and non-inverting inputs.

UNIT-III **6 Hrs.**

APPLICATION OF OP-AMP: Inverting and non-inverting amplifier, summing, scaling and averaging amplifier, integrator and differentiator, Oscillator Principles: oscillator types, frequency, stability response, the phase shift oscillator, Wein – bridge oscillator , L-C tunable oscillator, square wave generator.

UNIT-IV **6 Hrs.**

MICROPROCESSORS AND MICRO COMPUTER

Microprocessor and Architecture : Intel 8086 , Microprocessor architecture modes of memory addressing , 8086/8088 Hardware specification : Pin-outs and pin functions, clock generator (8284A) , Bus buffering and latching , Bus timing , Ready and wait state , Minimum mode versus maximum mode.

UNIT-V **6 Hrs.**

PROGRAMMING THE MICROPROCESSORS :

Addressing modes : Data addressing modes, program memory addressing modes, stack memory

addressing modes. Instruction set : data movement instruction , Arithmetic and login instructions, program control instruction . Programming example : Simple assembly language programs table handling direct table addressing , searching a table sorting a table pseudo ops.

Suggested Readings:

Digital principles and application : AP Melvino & DP Leech

OP- Amps & Linear Integrated circuits : R.A. Gaykwad