Dharmabad Shikshan Sanstha's

LAL BAHADUR SHASTRI MAHAVIDHYALAYA, DHARMABAD

PROFORMA FOR PROGRAM AND COURSE OUT COME9 (2.6.1)

Academic Year 2018-19

Name Of the Teacher: Dr. Y S Joshi

Department :- Physics

Program :- M.Sc F.Y. sem I **Subject :** Physics **Course Code** :- PH-01

Paper Title : Mathematical methods in physics

Unit No	Unit Name	Topics	Unit wise outcome
I	Matrices and Vector Space:	Definition, Algebra, Properties of matrices, Rank of matrix, Transformation, Inverse and trace of matrix, Characteristic root and characteristics vectors, Diagonalization of matrix, Linear dependence and independence of vectors, Inner product, Schmidt orthnormalization method.	Students will able to undustand matrices and problem solving
II	Fourier Series:	Fourier series, Evaluation of coefficients, Fourier cosine and sine series, Complex form of fourier series, Change to interval of fourier series, Applications of fourier series to; Square waves, Triangular waves, Sawtooth waves, Full wave and Half wave rectifier.	Special functions Are going to be introduced deeply
III	Integral Transform	Fourier transform, Fourier cosine transform, Fourier sine transform, Fourier transform, Fourier transform of derivatives, Dirac delta function derivation, Laplace transform, Laplace transform of some functions, Properties of Laplace transform, Laplace transform of derivatives, Inverse Laplace transform, Applications of fourier and Laplace transform.	Fourier series is useful in physics for acoustic and optics

IV	Special Functions:	Bessels differential equation, Some specific cases for Jn(x), Generating function of Jn(x), Orthoganility of Jn(x) Legendre's differential equation, Generating function for Pn(x), Specific cases for Pn(x), Recurance relationfor Pn(x), Rodrigues formula for Pn(x), Hermite differential equation, Specific cases for Hn(x), Recurrence relation for Hn(x), Orthogonality of Hn(x), Rodrigues formula for Hn(x).	Student learn complex number
V	Tensor Analysis:	Introduction, Defination of tensor in three dimensions, Definition of tensors in four dimensions, Rank of tensors, Covariant and contra-varient tensors, Symmetric and anti-symmetric tensors, Algebraic operations of tensors: Sum and Difference, Direct product, Contraction, Extension of the Rank, Quotient Law, Reciprocal tensors, Relative and absolute tensors, Index notation and summation conversion, Invariant tensors: kronecker delta symbol, Epsinal tensor, Krutkov tensor.	Students will able to understand matrices

Specify Course outcome : After completion of this course students are capable of using the learned mathematical techniques to solve problems in physics such as the use and applications of matrices, the differential equations, the special functions, Fourier series and integral transform and complex

Specify Program outcome : Objective of the course is to introduce the students to various mathematical methods that are needed for understanding and deriving various aspects of the core and applied courses of Physics. This course is also aimed to develop knowledge in mathematical physics and its applications,

Signature of Teacher

Name Of the Teacher: Mr. P G Hore

Department :- Physics

Program : M.Sc F.Y. sem I **Subject :** Physics **Course Code** :PH-02

Paper Title :- Classical Mechanics

Unit No	Unit Name	Topics	Unit wise outcome
I	Elementary Principles:	Introduction, Conservative and non conservative, Coordinate system, Degree's of freedom, Constraints; Classification of constraints, Virtual displacement and virtual work, D Alembert's principle, Newtonian mechanics for single and many particle system. (Various problems for all above)	To introduce the Newtons laws of motions
II	Lagrangian Formulation:	Largangian equation of motion, Variatio technique, Kinetic energy in terms of generalized coordinates, Jacobi integral, Rayleigh's dissipation function, Symmetry properties and Conservation laws; Invariance of Lagrangian equations under Galilean Transformation; Variational Principle. (Various Problems on the above)	Equations of motions are learned by lagrangian
III	Hamiltonian Formulation	Hamiltonian equations of motion, Principle of least action, Hamilton's principle and its characteristics, Hamilton-Jocobimethod,Canonical transformation, Generating function condition for canonical transformation, Definition of Poisson brackets, Poission's theorem and its properties, Jacobi identity. (Various problems for all above)	Equations of motions are learned by Hamiltonian
IV	Central Force:	Two-body problem; The equation of motion and first integral, Equation of orbit, Kepler's laws, Kepler's problem and general analysis of orbit, Stability of orbit, Rutherford scattering, Laboratory and center of mass system, Differential scattering cross section, Viral theorem.	Students able to understand Keplers laws of motions
V	Rigid Body Dynamics:	Euler's angles, Inertial forces, Angulan momentum of rigid body, Euler's equation of rigid body, Free motion of rigid body.	To introduce the Newtons laws of motions

Specify Course outcome : After completion of the course the students shall be able to apply Newton's laws of motion to solve complicated problems involving multiple bodies and use

the concepts of classical mechanics to the classical rigid bodies. The knowledge acquired through this course will enable the students to lay the foundation of application of the classical dynamics, space dynamics and also for modern physics.

Specify Program outcome : The main objective of this course is to introduce the students to apply mathematical formulation of mechanics problems and to interpret the solutions physically, to apply the concepts of classical mechanics to the rigid systems and to develop the skill of critical thinking and problem solving.

Signature of Teacher

Name Of the Teacher: Dr. A S Tak

Department :- Physics

Program : M.Sc F.Y. sem I **Subject :** Physics **Course Code** :PH-03

Paper Title :-Electronic Devices and Applications

Unit No	Unit Name	Topics	Unit wise outcome
I	Special Purpose Diodes and Other Devices:	LED, Schottky, Varactor, Tunnel, Photo Diodes, Photoconductive cell, LCD (Liquid Crystal Display), Solar cell, Thermistor, SCR, UJT, Photo transistor.	Students will able to understand the concept of semiconductor. and able to construct at industry levels
II	Multivibrators:	Switching characteristics of transistor, Switchig times of transistor, Astable, Monostable and bistable multivibrators.	Students will understand working of led Electron-hole pair Formation
III	Applications of OP-AMP:	Summing, Scaling and averaging amplifiers (Inverting), Instrumentation amplifier, Integrator, Differentiator, Comparator and Schmitt trigger. Active filters and Oscillators: First order Low-pass Butterworth filter, Second order Law-pass Butterworth filter, First order High-pass Butterworth filter, Second order Highpass Butterworth filter, Square wave generator, Voltage Controlled Oscillator (VCO).	Students are able to understand the many electronic devices and construct equipments at industry level
IV	Arithmetic Circuits:	Half adder, Full adder, Parallel binary adder. (Book 4)Multiplexers, DeMultiplexers (Book 4) Decoders, Encoders	Students will understand digital devices and are able to construct digital equipments
V	Sequential Circuits and Data Converters:	**Flip-Flops:** 1 Bit Memory Cell, S-R, J-K, Race Around Condition, JK Master Slave, D-Type, T-Type. (Book 4) **Registers:** SISO, SIPO, PISO and PIPO. (Book 6) **Counters:** Asynchronous Counters, Synchronous Counter, Synchronous	Students will able to understand the concept of semiconductor. and able to

		Counter Design. **Data Converters:** D/A and A/D Converters	construct at industry levels

Specify Course outcome : After completion of this course, students will be able to explain the working principles and application of various electronic devices used in various electronic gadgets of domestic uses. They will also understand the construction, working and operational characteristics of semiconductor devices and their applications in advanced electronics industries.

Specify Program outcome : This paper is aimed to enhance comprehension and application capabilities of the electronic devices that are being used in day to day life in the form of various gadgets like, mobile phone, television, microwave, calculators, computer, etc

Signature of Teacher

Name Of the Teacher:- Dr.K S Kanse

Department :- Physics

Program : M.Sc F.Y. sem I **Subject :** Physics **Course Code** : PH-04

Paper Title :- Atomic and Molecular Physics

Unit No	Unit Name	Topics	Unit wise outcome
I	The Atom Model for Two Valence Electrons:	Zeeman effect for two electrons, Intensity rules of Zeeman effect, Paschen-Back effect for two electons, Stark effect of hydrogen, Weak field stark effect in hydrogen, Strong field stark effect in hydrogen, Origin of hyperfine structure, Principles of resonance spectroscopy (ESR and NMR).	Students will understand the atomic structure and models
II	Molecular Physics:	Rotational spectra & diatomic molecular, Energy level factors affecting intensity of spectral lines, Spectra of non-rigid rotator, Microwave spectrometer, Isotopic substitution, Polyatomic molecules.	Spherical top molecule have no net dipole moment
III	Vibrational energy	Vibrational energy of diatomic molecule, Simple harmonic oscillator, Morse potential energy curve, Anharmonic oscillator, Molecule as a vibrating rotator, PQR branches, Born Oppenheimer approximation, IR spectrometer.	It is applied in clocks as an oscillator
IV	Electronic Spectra:	Diatomic molecule, series and progressions, Frank-Condom principle, Reemission processes, Fluorescence and phosphorescence, dissociation energy, Birge sponer method for determining dissociation energy.	Raman spectroscopy has wide variety of applications in biology and medicine
V	Raman Spectroscopy	Raman effect, Quantum theory of Raman effect, Classical theory of Raman effect, Polarizability ellipsoid. Pure rotational Raman spectra of diatomic and polyatomic molecules, Fundamental modes of vibrations, Raman activity of vibrations. Rule of mutual exclusion, nature of polarized light, structure determination from Raman and infrared spectroscopy, Technique and instrumentation.	Students will understand the atomic structure and models

Specify Course outcome : Upon successful completion of these modules, students will be able to understand and explain the following;

1. The atomic spectra of one valance electron atoms.
2. what is meant by LS and JJ coupling in case of two valance electron atoms and the origin of spin orbit interaction
3. Use appropriate quantum numbers for labeling of energy levels/terms symbols.
4. The change in behavior of atoms in external applied electric and magnetic field.

Specify Program outcome : Atomic and molecular physics is of great importance and very basic field in physics. The basic of all matter, which exist in nature, is based on atomic and molecular structure. It is one of the most important subjects for the testing grounds of the quantum theory. It helps in understanding, many fields of science and technology, namely spectroscopy, Laser Physics & Technology, Plasma Physics, Nuclear physics, Particle Physics, Astrophysics, Condensed

Signature of Teacher

Name Of the Teacher: Mr.A K Ghadge

Department :- Physics

Program :- M.Sc F.Y. sem I **Subject :** Physics **Course Code** : PH-08

Paper Title :- Quantum Mechanics

Unit No	Unit Name	Topics	Unit wise outcome
I	General Formalism of Quantum Mechanics I:	Physical Significance of wave function, Postulates of quantum mechanics, Quantum numbers, Physical Significance of Eigen function and Eigen value, Completeness of Eigen functions, Dirac delta function and its properties.	Students will understand the basic concepts of QM
II	General Formalism of Quantum Mechanics II:	Linear vector space, Hilbert space, Ket and Bra notations, Linear operators, Commutation relation for position and momentum operator, Hermitian operators, Matrix representation of an operator, Unitary operator, Unitary transformations.	Students can apply the QM to many quantum mechanical systems
III	Angular Momentum:	Commutation relations for Spin, Orbital and total angular momentum and Ladder operators, Eigen values of L2, LZ, J2, JZ, J-, Angular momentum and rotations, Rotational symmetry and conservation of angular momentum, Reflection invariance and Parity, Addition of angular momentum – Clebsch Coefficient.	Will be able to solve many problems in QM
IV	Approximation Methods:	(a) **Time independent perturbation theory:** Non-degenerate case- First order perturbations, Second order perturbation, application for the He atom, Degenerate case-Stark effect. (b) **Time dependent perturbation theory:** Zero order perturbation, First order perturbations, Second order perturbation, Fermi golden rule, Adiabatic and sudden approximation. (c) **Variation Method:** The basic principle, Application to excited state, Linear variation function application to two electron atom problem. (d) **WKB approximation:** The classical limit, One dimensional case, connection formulae, The turning point application to barrier poten.	Some of the advanced concepts can be understood by the students

V	Theory of Scattering and Symmetry in Quantum Mechanics:	Laboratory and Centre of Mass reference frames, Scattering amplitude, differential and total scattering cross section, Asymptotic form of scattering states, Relation between angles and cross sections in the laboratory and center of mass systems, Scattering by spherically symmetric potentials, Integral equation of scattering. The Born approximation, Partial Waves and Phase shifts, Scattering by a perfectly rigid sphere and by square well potential, Complex potential and absorption. Identical particles, symmetric and asymmetric wave factions and their construction for N particle system, Slater's determinant, Collision of identical particles (No Derivations)	Students will understand the basic concepts of QM

Specify Course outcome : Upon successful completion of these modules, students will be able to understand,that quantum mechanics is basic of many branches of Physics and will be able to apply quantum,theory to other applied areas like nuclear physics, atomic and molecular physics, solid state physics,laser physics etc.

Specify Programoutcome :- Quantum mechanics helps to understand of number of aspects of physics, chemistry, and modern technology. 1. To introduce the physical principles and the mathematical background important to quantum,**mechanical descriptions**. 2. To introduce the mathematical properties of the waves that describe free particles

Signature of Teacher

Name Of the Teacher: Mr. P G Hore

Department :- Physics

Program : M.sc.S.Y sem II **Subject :** Physics **Course Code** :PH-09

Paper Title :-Statistical Mechanics

Unit No	Unit Name	Topics	Unit wise outcome
I	Unit - I	**Fundamentals:** Macroscopic and microscopic state, Phase space, Ensemble and ensemble average, Liouville's theorem, Density matrix. b) **Microcanonical Ensemble:** Mictrocanonical distribution; Equal a priori probability, Entropy, Entropy of perfect gas in a microcanonical ensemble, Gibbs paradox, Thermodynamic quantities in a microcanonical ensemble; Sackur-Tetrode formula.	Students are able to apply the statistical mechanics at micro and macro level
II	Unit - II	a) **Canonical Ensemble:** Canonical distribution, Canonical partition function, Maxwell distribution of velocities, Thermodynamic quantities in a canonical ensemble, Classical system in canonical ensemble, Gibbs paradox. b) **Grand Canonical Ensemble:** Grand canonical distribution, Grand canonical partition function, Thermodynamic quantities in a grand canonical ensemble, Classical system in a grand canonical ensemble, Density and energy fluctuaions in a grand canonical ensemble	Students are able to apply the statistical mechanics at quantum level
III	Unit -III	a) **Maxwell-Boltzmann System:** Maxwell-Boltzmann distribution, Maxwell- Boltzmann velocity distribution law, Thermodynamical quantities; Gibbs paradox, Ideal Boltzmann gas with internal motions, Monatomic ideal gas with internal motions, Diatomic ideal gas, Ideal paramagnetism. b) **Fermi-Dirac Gas:** Weakly degenerate Fermi gas, Strongly degenerate Fermi gas, Thermionic emission, Statistical equilibrium in a white dwarf star.	Students are able to understand the statistical problems and solve them
IV	Unit IV	a) **Bose-Einstein Gas:** Bose-Einstein gas at high temperature, Bose-Einstein gas at low temperature, Planck's radiation law, Debye model of solids	Will be able to apply statistical

		(Phonons), Liquid He. b) **Interacting System:** Van der walls equation, Critical constants of a real gas, Virial equation, Cluster expansion for a classical gas.	mechanics at advanced level
V	Unit V	a) **Phase Transitions:** First-order phase transitions, Equilibrium between two phases, Clapeyron-Clausius equation, Scaling hypothesis, Critical indices Second-order phase transition, Ising model, Landau theory. b) **Kinetic and Dynamical Theories of Gases:** Boltzmann transport equation, Mean free path, Transport properties, Fluctuations and thermodynamics properties, Brownian motion, Langevin theory.	Students are able to apply the statistical mechanics at micro and macro level

Specify Course outcome : **T**he main outcome after learning the course is that students can apply and extend, concepts learned in this course to theoretical physics. Students will be well acquainted with the,particle nature on the basis of distribution laws and their uses in order to illustrate properties of most, exotic systems like white dwarf stars, super fluid materials, etc.

Specify Program outcome The main objective of this course is that students will be well aware of studying, physical properties of matter "in bulk" on the basis of dynamical behaviour of its microscopic, constituents. Fundamentals of heat and laws of thermodynamics with the help of statistics will be, covered in order to obtain physical properties on the basis of distribution laws including their, applications in view of classical and quantum statistics. The course also includes basics of phase, transition with their applications.

Signature of Teacher

Name Of the Teacher:- Dr. A G Chawhan

Department :- Physics

Program : M.sc. S.Y sem II **Subject :** Physics **Course Code:-** PH-10

Paper Title :- Condensed Matter Physics

Unit No	Unit Name	Topics	Unit wise outcome
I	Crystal Structure and Imperfections**:**	Crystal lattice and crystal structure, Translation symmetry, Space lattice, Unit cell and primitive cell, Bravais lattice in two and three dimensions, Co-ordination number, Some important crystal structure: Simple cubic structure (SC), Body centered cubic (BCC) structure, Face centered cubic (FCC) structure, Hexagonal close packed (HCP) structure, Wigner-seitz cells, Miller indices, The spacing of a set of a crystal Planes	After completing the course students will have knowledge of different types of solids and an understanding of how their microscopic structure
II	X-ray Diffraction and Reciprocal Lattice:	nteraction X-rays with matter; X-ray diffraction according to Braggs law,Reciprocal lattice, Properties of reciprocal lattice to simple cubic (SC) lattice, Body centered cubic (BCC) lattice and face centered cubic (FCC) lattice, The Bragg condition and Ewald construction, Brillion zones for one dimensional lattice, Two dimensional square lattice, Simple cubic lattice, Body centered cubic (BCC) lattice, Face centered cubic (FCC) lattice, Atomic scattering factor, Geometrical structure factor, Laue method, Rotating crystal method and powder method.	Students will able understand the Band theory
III	Band Theory:	Electron motion in crystal (One dimensional), Bloch theorem, Kroning-penny model, The concept of effective mass, Concept of holes, Metals insulators and semiconductor, The nearly free electron model, Tight binding approximations, Wigner-seitz cellular method, Orthogonalised plane wave (OPW), pseudo potential method, Fermi surface:	in semiconductor their resistivity is higher than conductor

IV	Superconductivity:	Introduction, Meissner effect, Critical temperature, Persistent current, The London theory, Type-I & II superconductors, Cooper pair, BCS theory, Flux quantization.	Students will able understand the Superconductivity
V	Magnetism:	Origin of Magnetic properties of material, Magnetic susceptibility, Classification of magnetic materials, Weiss molecular field theory of ferromagnetism, Heisenberg model, Curie Weiss law of susceptibility, Ferromagnetic domain and Hysteresis, Closure domains, The Bloch wall and Bloch wall energy, Antiferromagetism: two sublattice model, Neel temp, Susceptibility below Neel temperature, Ferrimagnetism: Structure of ferrites, Spin arrangement in Ferrite, Exchange interaction in Ferromagnets, Spain waves and magnons.	After completing the course students will have knowledge of different types of solids and an understanding of how their microscopic structure

Specify Course outcome : : After completing the course students will have knowledge of different types of solids and an understanding of how their microscopic structure affects their mechanical, thermal and electrical properties

Specify Program outcome : The main objective is to provide an overview of different types of materials and illustrate how their properties depend on the microscopic structure. The course will deliver basic knowledge, but it should also serve as an orientation on the current issues in the different branches of condensed matter physics, providing additional arguments for the choice of master thesis topic.

Signature of Teacher

Name Of the Teacher: Mr.P G Hore

Department :- Physics

Program : M.sc.S.Y sem II **Subject :** Physics **Course Code** :PH-11

Paper Title :- Numerical Techniques

Unit No	Unit Name	Topics	Unit wise outcome
I	Error Analysis:	Introduction, Least squares fitting (Uncertainty in the measurements of y, Constants A,B), Covariance and correlations, the Binomial and Poisson distribution, the chi-squared test for a distribution.	Numerical techniques to solve problems in physics related to the applications like data handling
II	Roots of Equation	Polynomial and transcendental equation, Limits for the roots of polynomial equation, Bisectional method, false position method, Newton Raphson method, Direct substitutation method, Synthetic division complex roots.	numerical techniques to solve problems in physics related to the applications like data handling
III	Numerical Integration and Solution of Differential Equation:	Newton cotes formula, Trapezoidal rule, Simpson's 1/3 rule. Simpson's 3/8 rule, Gauss quadratic method, Taylor series method. Euler's method, 2^{nd} order Runge Kutta method, Predictor corrector method.	solving the differential and integral equations, simultaneous equations and partial differential equations
IV	Curve Fitting and Integration:	Principle of least square feet, Fitting a straight line, Fitting a parabola, Cubic spline fitting, Linear interpolation, Difference Schemes, Newton's forward and backward interpolation formula.	solving the differential and integral equations, simultaneous equations and partial differential equations

V	Solution of Simultaneous Equations:	Gaussian elimination methods, Pivotal condensation method, Gauss Jordan Elimination method, Matrix inversion method, Gauss-seidal iteration method.	Numerical techniques to solve problems in physics related to the applications like data handeling and

Specify Course outcome : After completion of the course students shall be able to employ the studied numerical techniques to solve problems in physics related to the applications like data handling and fitting, finding solutions and root of equations, solving the differential and integral equations, simultaneous equations and partial differential equations. They shall also be well versed with writing their programmes using C-language of computer programming

Specify Program outcome : The main objective of the course is to introduce students to the useful numerical methods and tools that are being adopted for handling data in Physics. The course also aimed to introduce the students to C-Programing language, which is an essential tool for handling and solving numerical problems in physics.

Signature of Teacher

Dharmabad Shikshan Sanstha's

Lal Bahadur Shastri Mahavidyalaya, Dharmabad. 431809

Pro-forma for program and course outcomes (2.6.1) for academic year 2018-19

Name of Teacher: Dr K S Kanse

Department: Department of Physics, L B S College, Dharmabad

Program: M.Sc. S.Y. (2018-19) **Subject:** Physics **Course Code:** PH-15

Paper Title: Electrodynamics

Unit Number	Unit Name	Topic	Unit-wise Outcome
1	Maxwell's equations and Electromagnetic waves:	Maxwell's equations and their physical significance. Equation of continuity and relaxation time, Vector and scalar potentials, Lorentz and Coulomb gauge, electromagnetic energy and Poynting's theorem, electromagnetic wave equations in free space, their plane wave solutions, waves in conducting medium: skin depth, waves in ionized medium (ionospheric opagation) polarization of EM waves. Concept of radiation pressure	Students will be able to understand the Maxwell's equations
2	Electromagnetic waves in bounded media	Reflection and refraction of plane electromagnetic waves at a plane interface: normal incidence, oblique incidence, Fressnel's equations, and Brewster's angle. Total internal reflection. Reflection and refraction from metallic surfaces, Electromagnetic wave propagation between two parallel conducting plates, waves in hollow conductors, Rectangular wave guides – TE and TM modes	Students will be able to apply Maxwell's equations to various concepts
3	Radiations from moving charges	Concept of retarded potential, The Lienard-Wiechert potentials, Fields produced by moving charges, radiations from an accelerated charged particle at low velocities, radiations from a charged particles with co-linear velocity and acceleration, Radiations from an accelerated charged particle at low velocities in circular orbits-Larmor	Students will be able to understand the electric potentials and radiations

		formula, Radiations from an accelerated charged particle at relativistic velocities in circular orbitsrelativistic generalization of Larmor Formula	
4	Radiating Systems	Multipole expansion of EM fields, Electric dipole radiations, field due to oscillating electric dipole, magnetic dipole radiations, electric quadrupole radiation, fields due to linear, centre-fed antenna, simple array of antennas	Students will be able to understand various radiating systems
5	Relativistic Electrodynamics	Galilean transformations, Lorentz transformations and basic kinematical results of special relativity (length contraction, time dilation, addition of velocities, charge invariance, field transformation, etc), relativistic momentum and energy of a particle, mathematical properties of space-time in special relativity	Students will be able to understand and apply the relativistic concepts in electrodynamics

Course Outcome: Upon successful completion of this course students will be able to apply the knowledge of Maxwell's equations to a variety of problems including various types of charge distributions including time-dependent processes, tackle the problems related to the propagation and scattering of EM waves in a variety of media, understand how to design EM sources of different powers, and will also be able to have a good understanding of the relativistic electrodynamics.

Program Outcome: Student after completing their post graduation in Physics (M Sc Physics) will

1. be eligible to get employment as an assistant professor, teacher,. in private, semi government, government colleges and schools after fulfilling the requirements and can rise up to the top positions

2. pursue their higher studies in related fields including M Phil, Ph D in the national and international universities depending upon the eligibility conditions of the concerned universities.

3. work as research fellow, scientist in research institutes and carry out research after qualifying the NET/SET/PET examinations.

4. handle standard and advanced laboratory equipment, modern instrumentation and classical techniques to carry out experiments.

Signature of Teacher:

Name of Teacher: Mr. P G Hore

Department: Department of Physics, L B S College, Dharmabad

Program: M.Sc. S.Y. (2018-19) **Subject:** Physics **Course Code:** PH-16

Paper Title: Nuclear and Particle Physics

Unit Number	Unit Name	Topic	Unit-wise Outcome
1	Basic Nuclear properties	Nuclear size & its determination, nuclear radii by Rutherford scattering, electron scattering & mirror nuclei method, nuclear quantum numbers, angular Momentum, nuclear dipole moment, electric quadruple moment.	Students will get introduced to structure of nucleus
2	Interaction of nuclear radiation with matter	Interaction of charged particles & EM rays with matter, range, straggling, stopping power, ionization chamber, proportional counter, GM counter, scintillation detector, semiconductor detector.	Establishes an understanding of radiation and matter interactions
3	Nuclear forces and Nuclear Models	Elements of two body problem, charge independence & charge symmetry of nuclear forces, Meson theory of nuclear forces. Nuclear Models: B.E., Semi empirical mass formula & applications, nuclear shell model, liquid drop model collective model, collective model, Fermi gas model.	Introduces properties and structure of nucleus
4	Nuclear decay & Reactions	Radioactive decay, laws of successive transformation, dosemetry nuclear reactions, fission & fusion. β – decay, three forms of β - decay, Fermi theory of β - decay, kurie plot, selection ule, non conservation of parity in β - decay.	Students will understand concept of nuclear radiation
5	Elementary particles	Weak, strong & electromagnetic interaction, classification of elementary particles, conservation laws, quark theory	Students will get introduced to elementary particles

Course Outcome: After the completion of the subject the students are able to know its Scientific and technological applications in addition with social, economic and environmental implications.

Program Outcome: Student after completing their post graduation in Physics (M Sc Physics) will

1. be eligible to get employment as an assistant professor, teacher, in private, semigovernment, government colleges and schools after fulfilling the requirements and can rise up to the top positions

2. pursue their higher studies in related fields including M Phil, Ph D in the national and international universities depending upon the eligibility conditions of the concerned universities

3. work as research fellow, scientist in research institutes and carry out research after qualifying the NET/SET/PET examinations.

4. handle standard and advanced laboratory equipment, modern instrumentation and classical techniques to carry out experiments.

Signature of Teacher:

Name of Teacher: Prof. A G Chawhan

Department: Department of Physics, L B S College, Dharmabad

Program: M.Sc. S.Y. (2018-19) **Subject:** Physics **Course Code:** PH-17

Paper Title: Basics of Laser and Devices

Unit Number	Unit Name	Topic	Unit-wise Outcome
1	-	Properties of Lasers, Intensity, Monochromaticity, Directionality and coherence, Einstein's coefficients, Momentum transfer, Life time and possibility of amplification.	Students will get introduced to basics of lasers
2	-	Concepts of waves and interference, Temporal and spatial coherence, Coherence of the field and size of the source, Coherence and monochromaticity, Shape and width of spectral lines, Line broadening mechanism, Intrinsic broadening, collision broadening, Doppler broadening	Students will understand spectra of light
3	-	Basic principles of lasers, population inversion, Laser pumping, Two level and three level pumping, Vibrational modes and mode density of resonator, Open and confocal resonator.	Introduces the properties of Laser
4	-	Ruby laser, Three level system and its pumping power, Nd:YAG and Nd:Glass laser ,its energy level diagram and salient features. He-Ne lasers: Energy level diagram, construction and salient features of the He-Ne laser device, He-Cd and He-Sc laser: Energy level description and salient features, Molecular gas laser-CO2 gas laser, Energy level scheme and general features.	Introduces many types of Lasers
5	-	Nonlinear optics, Harmonic generation, Phase matching, Optical mixing parametric generation of light and self focusing. Applications of Lasers: Applications of lasers in (i) Communication (ii) Industry (iii) Medicine (iv) Biology (v) Astronomy.	Students will be able to understand applications of Lasers

Course Outcome: After the completion of the subject the students are able to know its Scientific and technological applications in addition with social, economic and environmental implications.

Program Outcome: Student after completing their post graduation in Physics (M Sc Physics) will:

1. be eligible to get employment as an assistant professor, teacher, in private, semigovernment, government colleges and schools after fulfilling the requirements and can rise up to the top positions

2. pursue their higher studies in related fields including M Phil, Ph D in the national and international universities depending upon the eligibility conditions of the concerned universities

3. work as research fellow, scientist in research institutes and carry out research after qualifying the NET/SET/PET examinations

4. handle standard and advanced laboratory equipment, modern instrumentation and classical techniques to carry out experiments.

Signature of Teacher:

Name of Teacher: Dr. D N Rander

Department: Department of Physics, L B S College, Dharmabad

Program: M.Sc. S.Y. (2018-19) **Subject:** Physics **Course Code:** PH-18-B

Paper Title: Materials Science

Unit Number	Unit Name	Topic	Unit-wise Outcome
1	Types of Materials and Glass	Terms related to Magnetic Materials, origin of magnetism, Classification of magnetic materials, Magnetic Domains, Magnetization, Magnetic anisotropy, Losses in magnetic materials, Factors effecting permeability and Hysteresis loss, soft and hard magnetic materials, Ferro fluids.	Students will get introduced to types of magnetic materials
2	Magnetic materials	Terms related to Magnetic Materials, origin of magnetism, Classification of magnetic materials, Magnetic Domains, Magnetization, Magnetic anisotropy, Losses in magnetic materials, Factors effecting permeability and Hysteresis loss, soft and hard magnetic materials, Ferro fluids.	Introduces basic properties of magnetic materials
3	Dielectric materials and Ferroelectric Materials	Dielectric as an electric field medium, Leakage currents, Dielectric losses, Breakdown voltage and Dielectric strength, break down in solid dielectrics, liquid dielectrics, Gases as dielectrics, polarization, Electrical conductivity in solid liquid and gaseous dielectrics. Applications of dielectric materials Common ferroelectric materials, Properties of ferroelectric materials in static field, spontaneous polarization, causes for existence of curie temperature, application of ferroelectric materials. Antiferroelectric materials, piezoelectric materials, pyroelectric materials	Introduces the dielectric materials and their applications
4	Bio Materials	General aspects of good timber, Advantages and disadvantages of Timber, Uses of timber, Defects in timber, seasoning of timber, Decay of timber, Testing timber. Play- wood, Lamin board, Black board, Fiber board, Hard Board.	Introduces many Bio-materials and their applications
5	Materials Synthesis	Solid State Reactions: general principles, processes of the reactions between solids, precursor, solution and gel methods, sealed tubes and special atmospheres, solution and hydrothermal methods, phase diagram and synthesis. Low temperature reactions, intercalation in layer structures, insertion	Students will be able to understand synthesis of many materials and able to

		compounds of metal oxides, ion exchange methods Synthesis by different wet chemical techniques viz., sol-gel, combustion, emulsion and polyol methods, Self-propagation combustion reaction, precursor dependent process, Microwave assisted process, Hydrothermal bomb calorimeter-hydrothermal and solvo-thermal process, Interfacial growth materials between the two immiscible phases,	apply these methods at industry level

Course Outcome: After the completion of the subject the students are able to know its Scientific and technological applications in addition with social, economic and environmental implications.

Program Outcome: Student after completing their post graduation in Physics (M Sc Physics) will:

1. be eligible to get employment as an assistant professor, teacher, in private, semigovernment, government colleges and schools after fulfilling the requirements and can rise up to the top positions

2. pursue their higher studies in related fields including M Phil, Ph D in the national and international universities depending upon the eligibility conditions of the concerned universities

3. work as research fellow, scientist in research institutes and carry out research after qualifying the NET/SET/PET examinations

4. handle standard and advanced laboratory equipment, modern instrumentation and classical techniques to carry out experiments.

Signature of Teacher:

Name of Teacher: Dr K S Kanse

Department: Department of Physics, L B S College, Dharmabad

Program: M.Sc. S.Y. (2018-19) **Subject:** Physics **Course Code:** PH-22

Paper Title: Fiber Optics and Optical fiber Communication

Unit Number	Unit Name	Topic	Unit-wise Outcome
1	Ray theory of transmission and preparation of optical fibers	Propagation of light in different media : propagation of light in an optical fiber, Basic structure and optical path of an optical fiber, Acceptance angle and acceptance cone, Numerical aperture(NA) (General), Modes of propagation, Meridional and skew rays, Number of modes and cut-off parameters of fibers. Fiber Fabrication Techniques : Chemical vapour deposition technique, Double crucible method.	Introduces many concepts of transmission media for optical fiber communication
2	Losses and Dispersion in Optical Fiber	Fiber Losses : Attenuation in optic fibers, Materials or impurity losses, Rayleigh scattering losses, Absorption loss, Leaky modes, Bending losses, Radiation losses. Dispersion in optical fiber : Electrical Vs. optical bandwidth. Bandwidth-length product, Intermodal dispersion, Mixing modes, Material chromatic dispersion.	Introduces many concepts related to transmission of light through optical fiber
3	Light Sources and Detectors for Optical Fiber	Light Sources : Introduction, LED (Light Emitting Diode), Processes involved, structure material and output characteristics of LED, Fiber LED coupling, Bandwidth, Spectral emission of LEDs, LASERS : Operation types, Spatial emission pattern, Current Vs. output characteristics.Detectors : Introduction, Characteristics of photodetectors (General), hotoemissive type, Photoconductive and photo voltaic devices, PN junction type, PIN photo diode, Avalanche photo diode (APD).	Students will be able to understand various sources of light and detectors for the communication purpose
4	Fiber optic sensors, Communication systems and Modulation	Fiber optic sensors : Introduction, Fiber optic sensors, Intensity modulated sensors, Micro bend strain intensity modulated sensor, Liquid level type hybrid sensor, internal effect intensity modulated sensor, Diffraction grating sensors and Interferometric sensors. Communication systems :Transmitter for fiber	Students will be able to understand the communication systems in details

		optic communication, High performance transmitter circuit LED – Analog transmitter, LASER transmitter, Digital laser transmitter, Analog laser transmitter with A/D conversion and digital multiplexing, Fiber optic receiver, Fiber based modems : Transreceiver. Modulation : LED analog modulation, Digital modulation, Laser modulation, Pulse code modulation (PCM), Intensity modulation (IM).	
5	Optical Fiber Communication and Measurements on Optical Fibers	Optical fiber communication systems : Introduction, Important applications of integrated optic fiber communication technology, Long haul communication, Coherent optical fiber communication, Principle of coherent detection. Measurements on Optical Fibers : Introduction, Measurements of numerical aperture (NA), Measurements of Fiber- attenuation, Optical time Domain Reflectometry (OTDR), Measurements of dispersion losses, Measurements of refractive index, Cut-off wavelength measurement, Measurements of Mode Field Diameter (MFD), Near field scanning technique.	Introduces many concepts of communication, various measurements

Course Outcome: After the completion of the subject the students are able to know its Scientific and technological applications in addition with social, economic and environmental implications.

Program Outcome: Student after completing their post graduation in Physics (M Sc Physics) will:

1. be eligible to get employment as an assistant professor, teacher, in private, semigovernment, government colleges and schools after fulfilling the requirements and can rise up to the top positions

2. pursue their higher studies in related fields including M Phil, Ph D in the national and international universities depending upon the eligibility conditions of the concerned universities

3. work as research fellow, scientist in research institutes and carry out research after qualifying the NET/SET/PET examinations

4. handle standard and advanced laboratory equipment, modern instrumentation and classical techniques to carry out experiments.

Signature of Teacher:

Name of Teacher: Dr. Y S Joshi

Department: Department of Physics, L B S College, Dharmabad

Program: M.Sc. S.Y. (2018-19) **Subject:** Physics **Course Code:** PH-23

Paper Title: Microwaves and Measurements

Unit Number	Unit Name	Topic	Unit-wise Outcome
1	Microwave Fundamentals	Microwave frequency spectrum, Types and characteristics of transmission line, Transmission line equation solution, Reflection coefficient and transmission coefficient, Standing wave and standing wave ratio, Line impedance and admittance, Smith chart.	Students will get introduced to Microwaves
2	Microwave Passive Devices	Rectangular wave guide, Circular wave guide, Microwave cavities, Microwave hybrid circuit, Directional coupler, Circulators and ferrit devices, Attenuators, Scattering matrix, Isolators.	Introduces many passive devises to generate MW
3	Microwave Active Devices	Klystron, Reflex Klystron, Velocity modulation, Basic principle of magnetron, Principles and operations of magnetrons and traveling wave tube, Transfer electron devices, Gunn diode, Pin diode.	Introduces many active devises to generate MW
4	Microwave Measurements	Attenuation measurement, Frequency measurement, Power measurement, Reflection coefficient and VSWR measurement, Scattering measurement. Microwave detection, Point contact diode, Schottly barrier diode, Impedance measurement using smith chart.	Students will be able to measure various properties of MWs
5	Microwave Applications	Antenna fundamental, Microwave antennas, Antenna basic, Power received from an antenna, Radiation pattern, Radiation resistance, Efficiency, Directivity and gain, Antenna types, Rectangular horn antennas, H and E plane Horn antennas, Pyramidal Horn antenna, Parabolic reflector antenna. Radar system, Basic radar system, Radar range, Moving target indicator, Time domain reflectometry, Network analyzer, Microwave dielectric measurement techniques.	Students will be able to apply use the microwaves and its sources at industry level also

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4. handle standard and advanced laboratory equipment, modern instrumentation and classical techniques to carry out experiments.

Signature of Teacher:

Name of Teacher: Dr. A S Tak

Department: Department of Physics, L B S College, Dharmabad

Program: M.Sc. S.Y. (2018-19) **Subject:** Physics **Course Code:** PH-24

Paper Title: Microprocessors and Microcontrollers

Unit Number	Unit Name	Topic	Unit-wise Outcome
1	Architecture of Microprocessor 8085	Intel 8085- Block diagram, ALU, Timing and control unit, Registers, Data and address bus, Pin configuration, Instruction word size, Instruction cycle, Fetch operation, Execute cycle, Machine cycle and state, Instructions and data flow, Timing diagram, Memory read, I/O read, Memory write, I/O write	Introduces many basic concepts of microprocessors
2	Programming of Microprocessor 8085 and Data Transfer Techniques	Introduction, Instruction set for 8085, Programming of 8085, Assembly language programming (Data Transfer, Arithmetic, Branching, and Logical group). Programmed data transfer, Synchronous, Asynchronous and interrupt drivers modes, DMA, Serial data transfer.	Students will be able to program the microprocessor
3	Advanced Microprocessors	Architecture of 8086, Pin diagram and pin function, Register organization, Minimum and Maximum mode of 8086, Microprocessor 80286, 80386 (Block Diagram only)	Introduces many advanced microprocessors
4	Micro-controller 8051	Introduction to 8 - bit micro-controller, Architecture of 8051 signal description of 8051, Register set of 8051, Important operational features of 8051, Memory and I/O addressing by 8051, Interrupts of 8051, Instructions set of 8051, programming of 8051 (Simple Arithmetic and Logical programs).	Students get introduced to the microcontroller and its programming
5	16 bit Micro-controller and Embedded Controller	Introduction, Architecture of 16 bit micro-controller (MCS-96 or 80196), General features of 80196, Register set of 80196, I/O processor, UPI 452 (Universal Peripheral Interface), Intel 80960 (block Diagram and its description only).	Introduces many advanced microcontrollers

Course Outcome: After the completion of the subject the students are able to know its Scientific and technological applications in addition with social, economic and environmental implications.

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3. work as research fellow, scientist in research institutes and carry out research after qualifying the NET/SET/PET examinations

4. handle standard and advanced laboratory equipment, modern instrumentation and classical techniques to carry out experiments.

Signature of Teacher:

Name of Teacher: Prof. A G Chawhan

Department: Department of Physics, L B S College, Dharmabad

Program: M.Sc. S.Y. (2018-19) **Subject:** Physics **Course Code:** PH-25A

Paper Title: Energy Physics

Unit Number	Unit Name	Topic	Unit-wise Outcome
1	Conventional and Non-conventional Energy Sources	Man and energy, world production and reserves of commercial energy sources- fossil fuel, hydroelectric power, Nuclear energy ,Indian energy scenario- fossil fuel, hydroelectric power, Nuclear energy power plants, Non-conventional Energy Sources- scope and potential, Concept of Solar constant, Solar intensity on earth's surface, Direct and diffused radiation ,Measurements of Solar Radiations – Moll-Gorezynsky pyronometer, Sunshine Recorder	Students will be introduced to various sources of energy
2	Photovoltaic Conversion Technologies	Crystalline Solar Cell Technology- purification of Silicon conversion of metallurgical grade silicon to semiconductor grade- Czocharlski crystalline silicon formation process, Processes involved in the conversion of silicon wafer to solar cell ,Modular design of solar cell, Power generation through satellite solar power station, Advantages and Disadvantages of solar cell	Students will understand the conversion of solar energy onto electrical energy
3	Photo thermal conversion technologies	Basic principles of flat plate collector (FPC), elements of flat plate collector, selective coatings and ideal characteristics of absorber plate of flat plate collector, Solar cooker, Hot water system, Solar dryer, Solar pond, Design of central tower receiving system for power generation, Essential elements of Solar Concentrators, parameters and efficiency of solar concentrators, Cylindrical parabolid concentrators (PTC), Compound parabolid concentrators (CPC), Applications of solar concentrators	Students will understand the conversion of solar energy onto thermal energy
4	Biogas	Principles of biogas production, The anaerobic digestion process, types of systems (standard and high rate system) proportion of gases in biogas, Design of the plant, process control consideration (temperature, pH), gas production, gas collection, gas utilization, Advantages and Disadvantages of	Students are able to use the Biogas for many purposes at domestic and industry level

		biogas plant.	
5	Fuel Cells	Hydrogen as source of energy, photo electrochemical cell, source of hydrogen, solar hydrogen through electrolysis and photo catalytic process, hydrogen storage, brief discussion of various processes, concept of fuel cell, thermodynamics of fuel cell, merits and demerits of fuel cell.	Students will be able to apply the fuel cells at industry level

Course Outcome: After the completion of the subject the students are able to know its Scientific and technological applications in addition with social, economic and environmental implications.

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2. pursue their higher studies in related fields including M Phil, Ph D in the national and international universities depending upon the eligibility conditions of the concerned universities

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Signature of Teacher: