KISAN POST GRADUATE COLLEGE, BAHRAICH (UP)-271801
(An Autonomous College)

Proposed Structure of syllabus for the
PROGRAM: MASTER OF SCIENCE
SUBJECT-PHYSICS

Syllabus developed/proposed by

S. No.	Name	Designation	Department	College/University
1.	Dr. Kishun Bir	Associate Professor	Physics	Kisan Post Graduate College, Bahraich
2.	Dr. Geetika Srivastava	Associate Professor	Physics & Electronics	Dr. Rammanohar Lohia Awadh University, Ayodhya
3.	Prof. (Dr.) J. P. Pandey (Principal)	Professor	Physics	M.L.K.P.G. College, Balrampur
4.	Prof. (Dr.)C.R. Gautam	Professor	Physics	Lucknow University, Lucknow
5.	Dr. Bal Govind	Assistant Professor	Physics	Kisan Post Graduate College, Bahraich
6.	Mr. Akhilesh Kumar Upadhyay	Assistant Professor	Physics	Kisan Post Graduate College, Bahraich
7.	Prof. (Dr.) Sameer Sinha	Professor	Physics	Ganpat Sahaai P.G. College, Sultanpur

Course Code		Course Title	Credits	T/P	Evaluation	
					CIE	ETE
A	B	C	D	E	F	G
SEMESTER-I						
B010701T	CORE	Mathematical Methods for Physic	5	T	25	75
B010702T	CORE	Classical Mechanics	5	T	25	75
B010703T	CORE	Quantum Mechanics	5	T	25	75
B010704T	FIRSTELECTIVE	Numerical Methods and C Programming	5	T	25	75
B010705T	**(Select any one)**	Lasers, Optical Fibers and Sensors	5	T	25	75
B010706P	SECOND ELECTIVE	Physics Lab-I	5	P	50	50
B010707P	**(Select anyone)**	Electronics lab-I	5	P	50	50
SEMESTER-II						
B010801T	CORE	Advanced Quantum Mechanics	5	T	25	75
B010802T	CORE	Electrodynamics	5	T	25	75
B010803T	CORE	Electronics	5	T	25	75
B010804T	THIRDELECTIVE	Physics in Daily Life	5	T	25	75
B010805T	**(Select any one)**	Home Appliances	5	T	25	75
B010806P	FOURTH ELECTIVE	Physics Lab-II	5	P	50	50
B010807P	**(Select any one)**	Electronics lab-II	5	P	50	50
SEMESTER-III						
B010901T	CORE	Nuclear Physics	5	T	25	75
B010902T	CORE	Atomic & Molecular Spectroscopy	5	T	25	75
B010903T	CORE	Digital Electronics and Microprocessor	5	T	25	75
B010904T	FIFTHELECTIVE	Statistical Physics	5	T	25	75
B010905T	(Select any one)	Renewable Energy Resources	5	T	25	75
			5	T	25	75
B010906P	SIXTHELECTIVE	Physics Lab-III	5	P	50	50
B010907P	(Select any one)	Electronics lab-III	5	P	50	50
SEMESTER-IV						
B011001T	CORE	Condensed Matter Physics	5	T	25	75
B011002T	CORE	Communication and Microwave Electronics	5	T	25	75
B011003P	SEVENTH ELECTIVE (Select	Physics Lab-IV	5	P	50	50
B011004P	Anyone)	Electronics lab-IV	5	P	50	50
B011005P	RESEARCH PROJECT / DISSERTATION	Major Research Project/ Dissertation	10	P	50	50

M.Sc. (SEMESTER-I) PAPER-I

Programme: Class: M.Sc.	Year: 1	Semester: I
Subject: PHYSICS		
Course Code:B010701T	Course Title: Mathematical Methods For Physics	
Credits: 5	Core	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:		

Unit	Topics	No. of Lectures
	MATEMETICAL METHODS FOR PHYSICS	
I	**Errors and Measurements:** Accuracy and Precision, Calculation of Percentage Error, Least Squares-Fitting, Straight Line-Fitting, Parabola-Fitting and Exponential Curve-Fitting (y=axb), Simpsons 1/3 and ¾ rule, Trapezoidal rule, Ranga-Kutta 1st and 2nd order for integral calculations.	
II	**Special Functions:** Legendre's, Bessel, Hermite and Laguerre Polynomials, Equations and their Solutions, Orthogonality conditions and Recurrence Relations, Green's function.	
III	**Complex Variables:** Analytic Functions, Cauchy Riemann Condition, Singular points, Branch points, Cauchy Integral Formula, Milne-Thompson Method, Taylor and Laurent Expansions – Zeros and poles, Residue theorem - applications to evaluation of definite integrals.	
IV	**Laplace and Fourier Transform:** Laplace transforms and its applications, Fourier transform and Fourier Coefficients, Fourier integral. Matrices, Cayley-Hamilton Theorem, Eigen values and Eigenvectors for degenerate and non-degenerate case.	

Suggested Readings:

1. Mathematical method for Physicists, Arfken& Weber, Elsevier Academic Press
2. Mathematical Method for Physics and Engineers, K.F.Reily, M.P.Hobson and S.J.Bence, Cambridge University Press
3. Advanced Engineering Mathematics, E. Kreyszig, John Wiley & Sons
4. Special Functions, E.D. Rainville, Chelsea Publication Co.
5. Special Functions for Scientists and Engineers, W.W. Bell, Dover Publications
6. Mathematical Physics: H. K. Das, S. Chand Publication.

This course can be opted as an elective by the students of the following subjects: Open to all

Suggested Continuous Evaluation Methods (Max. Marks: 25)

S.No.	Assessment Type	Max. Marks
1.	Mid Term Exam/Test	15
2.	Assignment/Presentation	10

Course prerequisites: B.Sc. in Physics/B.Tech./B.E.

M.Sc. (SEMESTER-I) PAPER-II

Programme: Class: M.Sc.	Year: 1	Semester: I
Subject: PHYSICS		
Course Code: B010702T	**Course Title: Classical Mechanics**	
Credits: 5	**Core**	
Max. Marks: 25+75	**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:		

Unit	Topics	No. of Lectures
	CLASSICAL MECHANICS	
I	**Lagrangian Formulations:** Conservation Law (momentum and energy). Constraints, generalized coordinates, D'Alembert's principle, Lagrange's equations of motion and its application, Variational principle Cyclic Coordinate, Simple Pendulum, Compound Pendulum. Relativistic Kinematics and mass energy equivalence.	
II	**Hamilton Formulations:** Generalized momenta, canonical variables, Legendre transformations and the Hamilton's equation of motion and applications, Principal of least action, Relation between Langrangian and Hamiltonian, Hamiltons-Jacobi Indentity, Canonical transformation and Generating function, Poission Bracket.	
III	**Central Force Problem:** Langrangian equation of motion, Equation of orbit, The Kepler's problem, Viral Theorem. Rigid Body problem, principle moment of inertia tensor of different symmetrical systems.	
IV	**Small Oscillations:** Stability Analysis, Stable and Non-Stable equilibrium, Quadratic forms for kinetic and potential energies of a system in equilibrium, Lagrange's equations of motion, Normal modes and normal frequencies, examples of (a)longitudinal vibrations of two coupled harmonic oscillators (b) linear, symmetric, triatomic molecule, (c) oscillations of two linearly coupled plane pendulum.	

Suggested Readings:

1. Classical Mechanics, H. Goldstein, Narosa Publishing House
2. Classical Mechanics, N.C. Rana and P.S. Joag, Tata McGraw Hill
3. Introduction to Dynamics, I.C. Percival and D. Richards, Cambridge University Press.
4. Classical Mechanics, Gupta and Kumar, Pragati Prakashan, Meerut.

This course can be opted as an elective by the students of the following subjects:
Open to all

Suggested Continuous Evaluation Methods (Max. Marks: 25)

S.No.	Assessment Type	Max. Marks
1.	Mid Term Exam/Test	15
2.	Assignment/Presentation	10

Course prerequisites: B.Sc. in Physics/B.Tech. /B.E.

M.Sc. (SEMESTER-I) PAPER-III

Programme: Class: M.Sc.	Year: 1	Semester: I
Subject: PHYSICS		
Course Code: B010703T	**Course Title:** QUANTUM MECHANICS	
Credits: 5	**Core**	
Max. Marks: 25+75	**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:		

Unit	Topics	No. of Lectures
	QUANTUM MECHANICS	
I	**Basic formalism**: Postulates of quantum Mechanics, Schrödinger equation (Time dependent and independent), Ehrenfest's theorem - Expectation Value, Hermitian Operators for dynamical variables - Eigen values and Eigen functions, Heisenberg Uncertainty Principle.	
II	**One Dimensional and Three-Dimensional Problems:** Square well potential, simple harmonic oscillator, Three Dimensional: Orbital angular momentum and spherical harmonics - Central forces and reduction of two body problem - Particle in a Spherical well - Hydrogen atom.	
III	**General Formalism:** Hilbert's space - Dirac notation - Representation theory - Co-ordinate and momentum representations - Time evolution - Schrödinger, Heisenberg and Interaction pictures - Symmetries and conservation laws - Unitary transformations associated with translations and rotations. Pauli matrices and their operations.	
IV	**Approximation Methods:** Time-independent perturbation theory for non- degenerate and degenerate levels - Application to ground state of an harmonic oscillator and Stark effect in Hydrogen.	

Suggested Readings:

1. Introduction to Quantum Mechanics by David J. Griffiths, Pearson (2005).
2. Quantum Mechanics by G. Aruldhas, PHI, India.
3. Quantum Mechanics: Concepts and Applications by N. Zettili, Wiley
4. Quantum Mechanics by L.I. Schiff, Tata Mcgraw Hill Education Private Limited Tata Mcgraw Hill Education Private Limited (2010).
5. Modern Quantum Mechanics by J. J Sakurai, Pearson (1994).
6. Quantum Mechanics: Theory And Applications by A. Ghatak, Macmillan India Limited (2004).
7. Quantum Mechanics: An Introduction by Walter Greiner, Springer (India) Pvt. Ltd. (2008).
8. Quantum Physics: Of Atoms Molecules Solids Nuclei and Particles by Robert Resnick and Robert Eisberg, Wiley India Pvt Ltd (2006).

This course can be opted as an elective by the students of the following subjects: Open to all

Suggested Continuous Evaluation Methods (Max. Marks: 25)

S.No.	Assessment Type	Max. Marks
1.	Mid Term Exam/Test	15
2.	Assignment/Presentation	10

Course prerequisites: B.Sc. in Physics/B.Tech./B.E.

M.Sc. (SEMESTER-I) PAPER-IV

Programme: Class: M.Sc.	Year: 1	Semester: I
Subject: PHYSICS		
Course Code: B010704T	Course Title: NUMERICAL METHODS AND C PROGRAMMING	
Credits: 5	Elective	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:		

Unit	Topics	No. of Lectures
	NUMERICAL METHODS AND C PROGRAMMING	
I	**Algebraic and Transcendental Equations:** The Iteration Method –Method of false position-Newton-Raphson method – Convergence of Newton-Raphson Method – Bisection method – Order of Convergence for N-R Method.	
II	**Interpolation:** Linear Interpolation-Gregory-Newton forward and Backward Interpolation formula Central difference formula-Gauss forward and backward interpolation formula Lagrange's interpolation formula-Newton's formula for unequal Intervals.	
III	**Numerical Differentiation and Integration:** Numerical Differentiation for solving first order differential equations: -Euler's Method-Improved Euler's method -Runge-Kutta second and fourth order method for solving first order differential equations. Numerical Integration: Trapezoidal rule-Simpson's 1/3rd rule-formula and derivation.	
IV	**C Program:** Primary data types-Constants-Integers-Various types of operators and expressions-Control structure-if-if-else– go to – while – do, while – for statements-declaration and initialization of arrays(1-d,2-d)-Functions-Calling a function-Return values and their types. Development of C program for 1) Fitting a straight line, 2) Newton-Raphson method, 3) Lagrange's Interpolation 4) Euler's method, 5) R.K Second order, 6) Trapezoidal rule.	

Suggested Readings:

1. B.P.Flannery, S.A.Teukolsky, W.T.Vetterling, Numerical Recipes in C, W.H. Press, Cambridge University (1996).
2. M.K.Venkataraman, Numerical methods in Science and Engineering, National Publishing Company, Chennai (2004).
3. E.Balagurusamy, Programming in ANSI – C, Tata McGraw Hill publications (2004).
4. S.S.Sastry, Introductory Methods of Numerical Analysis, PHI, New Delhi (2003).
5. Numerical Methods in Science and Engineering – The National Publishing Co. Madras (2001).
6. Veerarajan, Numerical Methods in C and C++, S. Chand, New Delhi (2006).

This course can be opted as an elective by the students of the following subjects: Open to all

Suggested Continuous Evaluation Methods (Max. Marks: 25)

S.No.	Assessment Type	Max. Marks
1.	Mid Term Exam/Test	15
2.	Assignment/Presentation	10

Course prerequisites: B.Sc. in Physics/B. Tech./B.E.

M.Sc. (SEMESTER-I) PAPER-V

Programme: Class: M.Sc.	Year: 1	Semester: I
Subject: PHYSICS		
Course Code:B010705T	Course Title: Laser, Optical Fibers and Sensors	
Credits: 5	Elective	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:		

Unit	Topics	No. of Lectures
	LASER, OPTICAL FIBRES AND SENSORS	
I	LASERS and MASERS, Concept of Population Inversion, Laser Pumping, Resonators, Ruby laser, Helium Neon laser, Semiconductor lasers, Properties of lasers, Applications of LASER in different fields.	
II	The promise of Optical information processing, Evolution of Fiber Optics, Optical fiber Communication System, Block diagram of Optical fiber Communication System, Light propagation through medium, Total internal reflection, Numerical Aperture, Acceptance Angle.	
III	The optical fiber, Structure and types of fiber, Single mode fiber, Multimode Fiber, Step-index fiber, Graded-index fiber, Attenuation loss, Fiber materials, Fabrication of Optical fibers, Mechanical Misalignment, Fiber joints and Couples, Fiber Splicing, Demonstration of fiber optic communication.	
IV	Optical Sensors, Advantages of optical Sensors, Properties of Sensors, Sensors types, Electrical and Magnetic Sensors, Rotation Sensors, Fiber-Optic Gyroscope.	

Suggested Readings:

1. Optical Communication System: John Gower, Prentice Hall of India.
2. Fiber Optics Communication: Palais, University Press.
3. Introduction to Optical Fibers and its Applications: Rajesh Shukla LAP LAMBERT Academic Publishing.
4. Nonlinear Fiber Optics: G.P. Agarwal, Academic Press, San Diego California.
5. Laser: Eberly
6. Principles of Laser: Orazio Svelto, Springer.
7. Introduction to Optics: Anchal Srivastava etc. New Age International Publishers, New Delhi.
8. Laser, Theory and Applications: K. Thyagarajan

This course can be opted as an elective by the students of the following subjects: Open to all

Suggested Continuous Evaluation Methods (Max. Marks: 25)

S.No.	Assessment Type	Max. Marks
1.	Mid Term Exam/Test	15
2.	Assignment/Presentation	10

Course prerequisites: B.Sc. in Physics/B.Tech./B.E.

B010706P Physics Lab-I	
Sr.no.	**A. List of Experiments**
1.	To determine Planck's constant by photocell
2.	Michelson Interferometer - Thickness of mica sheet.
3.	Verification of Stefan's law for black body radiation
4.	Determination of the velocity of Ultrasonic waves in solids/liquids
5.	Specific charge of an electron -Thomson's method / Magnetron method
	B. Project Presentation / Seminar on an assigned topic
	Marks Distribution
1.	ETE: One practical – 50
2.	CTE: Practical record (20) + Seminar (30) = 50

B010707P Electronics Lab-I	
Sr.no.	**A. List of Experiments**
1.	Study of Half / Full Bridge rectifier circuits with filters
2.	Setting up a Power Supply using a Zener Diode as Voltage Regulator
3.	Study of Bipolar Junction Transistor Static Characteristics
4.	Study of CE, CB and CC configuration of BJT circuit
5.	Study of Field Effect Transistor Characteristics
	B. Project Presentation / Seminar on an assigned topic
	Marks Distribution
1.	ETE: One practical – 50
2.	CTE: Practical record (20) + Seminar (30) = 50

M.Sc. (SEMESTER-II) PAPER-I		
PROGRAMME: CLASS: M.Sc.	**YEAR: I**	**SEMESTER: II**
SUBJECT: PHYSICS		
COURSE CODE: B010801T	**COURSE TITLE:** ADVANCED QUANTUM MECHANICS	
Credits: 5	**Core**	
Max. Marks: 25+75	**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:		

Unit	Topics	No. of Lectures
	Advanced Quantum Mechanics	
I	**Perturbation Theory:** Perturbed oscillator, first order Stark effect, Zeeman effect, Variation method: Basic principles, Applications to: One dimensional harmonic oscillator, Ground state energy of hydrogen atom, Time dependent perturbation theory, Emission and absorption of radiation, Spontaneous emission. WKB Method.	
II	**Relativistic Quantum Mechanism:** Free particle Klein-Gordan equation, Charge and current densities, Minimal electromagnetic coupling, Dirac's relativistic equation, Covariant form of the Dirac's equation, Adjoint Dirac equation, Continuity equation. Scattering theory: Partial Wave Analysis, Born-Approximation,	
III	**Dirac equation:** Free particle solutions, Dirac and Feynman interpretation of negative energy states, Dirac equation in electromagnetic field and its non-relativistic reduction, Dirac's equation in a central field: spin angular momentum, spin-orbit energy, the hydrogen atom.	
IV	**Quantization of Fields:** Hilbert space, Dirac's Bra and Ket Vectors: Dual Space, Matrix form of the Wave Function, Symmetric and Anti-Symmetric wave functions. Pauli's Matrices and their commutations relations.	

Suggested Readings:

1. Quantum Mechanics by L.I. Schiff, Tata Mcgraw Hill Education Private Limited Tata Mcgraw Hill Education Private Limited (2010).
2. Introduction to Quantum Mechanics by David J. Griffiths, Pearson (2005).
3. Advanced Quantum Mechanics by J. J Sakurai, Pearson (2005).
4. Quantum Mechanics: Theory and Applications by A. Ghatak, Macmillan India Limited (2004).
5. Relativistic Quantum Fields by James D. Bjorken, Sidney D. Drell, Dover publications (2012)
6. A First Book of Quantum Field Theory by A Lahiri, Narosa Book Distributors Pvt Ltd (2005).
7. Quantum Field Theory by F. Mandl and G. Shaw, John Wiley & Sons (20100525).
8. Principles of Quantum Mechanics by R. Shankar, Springer (2006).

This course can be opted as an elective by the students of the following subjects: Open to all

Suggested Continuous Evaluation Methods (Max. Marks: 25)

S.No.	Assessment Type	Max. Marks
1.	Mid Term Exam/Test	15
2.	Assignment/Presentation	10

Course prerequisites: M.Sc. in Physics I Semester

M.Sc. (SEMESTER-II) PAPER-II		
PROGRAMME:CLASS: M.Sc.	**YEAR: I**	**SEMESTER: II**
SUBJECT: PHYSICS		
COURSE CODE: B010802T	**COURSE TITLE:** ELECTRODYNAMICS	
Credits: 5	**Core**	
Max. Marks: 25+75	**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:		

Unit	Topics	No. of Lectures
	Electrodynamics	
I	Electrostatics, Differential equation for electric field, Poisson and Laplace equations, Boundary value problems, Solutions of Laplace equation in cylindrical and spherical coordinates by orthogonal functions, dielectrics, polarization of a medium, electrostatic energy.	
II	Maxwell's Equations Displacement current, Vector and scalar potentials, gauge symmetry, Coulomb and Lorentz gauges, electromagnetic energy and momentum, conservation laws, inhomogeneous wave equation and Green's function solution. Electromagnetic Waves: Plane waves in a dielectric medium, reflection and refraction at dielectric interfaces, wave propagation in one dimension, boundary conditions at metallic surfaces, propagation modes in wave guides, resonant modes in cavities.	
III	Radiation Field of a localized oscillating source, fields and radiation in dipole and quadrupole approximations, radiation by moving charges, Lienard- Wiechert potentials, Total power radiated by an accelerated charge, Lorentz formula.	
IV	Concepts of Plasma Physics Formation of plasma, Debye theory of screening, plasma oscillations, motion of charges in electromagnetic fields, magneto-plasma, and plasma confinement.	

Suggested Readings:

1. J.D. Jackson, Classical Electrodynamics.
2. D.J. Griffiths, Introduction to Electrodynamics.
3. J.R. Reitz, F.J. Milford and R.W. Christy, Foundations of Electromagnetic Theory.
4. W.K.H. Panofsky and M. Phillips, Classical Electricity and Magnetism.
5. F.F. Chen, Introduction to Plasma Physics and Controlled Fusion.

This course can be opted as an elective by the students of the following subjects: Open to all

Suggested Continuous Evaluation Methods (Max. Marks: 25)

S.No.	Assessment Type	Max. Marks
1.	Mid Term Exam/Test	15
2.	Assignment/Presentation	10

Course prerequisites: M.Sc. in Physics I Semester

M.SC. (SEMESTER-II) PAPER-III		
PROGRAMME:CLASS: M.Sc.	**YEAR: I**	**SEMESTER: II**
SUBJECT: PHYSICS		
COURSE CODE: B010803T	**COURSE TITLE:** ELECTRONICS	
Credits: 5	**Core**	
Max. Marks: 25+75	**Min. Passing Marks:**	

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:

Unit	Topics	No. of Lectures
	Electronics	
I	**Operational Amplifier:** Introduction to OP-Amp, Basic parameters, Applicability of OP-Amp in analog computation, OP-Amp as voltage follower, Adder, Subtractor, Integrator, Differentiator, Log amplifier, Anti-log Amplifier, Analog multiplier & divider circuit. OP-Amp as Low pass filter, High Pass, Band pass filter and Band elimination filter.	
II	**Transistor Oscillators:** Oscillator as positive feedback amplifier, Condition of sustained oscillations, Phase shift and Wein bridge Oscillator, Hartley & Colpitts circuit, Negative resistance oscillator, Frequency stability & distortion in oscillators, Miller circuit.	
III	**Non-Sinusoidal Generators:** Multi vibrators, Bistable, Mono stable and a stable multivibrator, Saw tooth wave generators, Pulse generator, Clipping and Clamping circuits.	
IV	**Power Electronics: Power Devices:** SCR- basic structure, I-V characteristics and two transistor model, DIAC and TRIAC, Basic structure, Operation timer and equivalent I-V characteristics, TRIAC as high-power switch, DIAC as triggering device of TRIAC, UJT in over voltage protection, Saw tooth wave generation using UJT. Regulator Circuits: Load and Line regulation, Stabilization ratio, Internal impedance and temperature coefficient of voltage regulation, Linear voltage regulation circuit.	

Suggested Readings:

1. Principle of electronics – V K Mehta
2. Switch model power conversion basic theory & design – Kitscem (MorcelDecnar, New York)
3. Power Electronics- P C Sen (Tata McGraw Hill)
4. Electronic Devices & Circuits- Millman & Halkias
5. Functional Electronics- Raja Raman

This course can be opted as an elective by the students of the following subjects: Open to all

Suggested Continuous Evaluation Methods (Max. Marks: 25)

S.No.	Assessment Type	Max. Marks
1.	Mid Term Exam/Test	15
2.	Assignment/Presentation	10

Course prerequisites: M.Sc. in Physics I Semester

M.SC. (SEMESTER-II) PAPER-IV		
PROGRAMME: CLASS: M.Sc.	**YEAR: I**	**SEMESTER: II**
SUBJECT: PHYSICS		
COURSE CODE: B010804T	**COURSE TITLE:** PHYSICS IN DAILY LIFE	
Credits: 5	**Elective**	
Max. Marks: 25+75	**Min. Passing Marks:**	

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:

Unit	Topics	No. of Lectures
	Physics in Daily Life	
I	**Units, Dimensions and Errors:** Fundamental and derived quantities. Units and dimensions, dimensional analysis, order of magnitude, significant figures, errors. **Light:** Reflection, refraction, diffraction, interference, scattering (elementary ideas only) – examples from daily life – apparent depth, blue color of sky, twinkling of stars. Total internal reflection, mirage, sparkling of diamond, primary and secondary rainbow – optical fibers. Concave and convex mirrors, lenses – focal length, power of a lens, refractive index, prism, dispersion. Human eye, defects of the eye – myopia, hypermetropia, presbyopia and astigmatism and their correction by lens.	
II	**Motion:** Velocity, acceleration, momentum, Idea of inertia, force - laws of motion. Newton's law of gravitation, acceleration due to gravity, mass and weight, apparent weight, weightlessness. Rotational motion, Moment of inertia, torque, centripetal and centrifugal acceleration examples- banking of curves, centrifugal pump etc.	
III	**Electricity:** Voltage and current, ohms law. Electric energy, electric power, calculation of energy requirement of electric appliances – transformer, generator, hydroelectric power generation – wind power – solar power – nuclear power **Matter and energy:** Different phases of matter, fluids - surface tension, viscosity capillary rise, Bernoulli's theorem and applications. Heat energy, temperature, different temperature scales – degree Celsius, Fahrenheit and Kelvin. Waves – transverse and longitudinal waves, sound waves, Doppler Effect. Lasers, fluorescence, phosphorescence, electromagnetic waves-applications-microwave oven, radar, super conductivity.	
IV	**Universe: Planets:** solar system, moon- faces of moon, lunar and solar eclipses, constellations, Different types of stars, Galaxies, black hole. Satellites, Artificial satellites, Global positioning system. Geo stationary satellite.	

Suggested Readings:

1. Fundamentals of Physics with Applications by Arthur Beiser
2. Conceptual Physics byPaul G Hewitt

This course can be opted as an elective by the students of the following subjects: Open to all

Suggested Continuous Evaluation Methods (Max. Marks: 25)

S.No.	Assessment Type	Max. Marks
1.	Mid Term Exam/Test	15
2.	Assignment/Presentation	10

Course prerequisites: M.Sc. in Physics I Semester

M.Sc. (SEMESTER-II) PAPER-V		
Programme: Class: M.Sc.	**Year:**	**Semester: II**
Subject: PHYSICS		
Course Code: B010805T	**Course Title:** Home Appliances	
CO: Understand the working principles and applications of latest Appliances.		
Credits: 5	**Elective**	
Max. Marks: 25+75	**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:		

Unit	Topics	No. of Lectures
	Home Appliances	
I	**CAUTION PRACTICED IN ADVANCE:** Electricity – Basic principles - Practical unit of electricity - Electric shock– Precautions to avoid electric shock– Rescue steps in electric Shock - Electric Line Circuit Breaker (ELCB). **WIRING:** Wiring system – Electric supply to house and factories – Types of wiring– ISI Rules – Megger testing – Ear thing. Electricity in house: Design for heating element– Electric iron, Table heater, Hot plate and Room heater.	
II	**ELECTRICAL MEASURING INSTRUMENTS:** Moving coil instruments– Voltmeter – Ammeter – Wattmeter– Kilowatt meter– Frequency meter– Multimeter.	
III	**ELECTRICAL APPLIANCES:** Electric fan – Refrigerator – Air Conditioner – Air cooler. Electric bell – Buzzer -Washing machine	
IV	**LIGHT:** Incandescent lamp – Fluorescent lamp – LED lamp - Solar powered street lights.	

Suggested Readings:

1. A.L. Anwani and I. Anwani, Basic Electrical Engineering, Dhanpat Rai and Co (P) Ltd., Delhi, 2003. (Units 1to 5)
2. William D. Cooper, Electrical Instruments and Measurement Techniques, PHI Pvt Co., New Delhi, 1997. (Units 2,3&4)
3. S. P. Bali, Consumer Electronics, Pearson Education, India,2005.
4. B. L. Theraja, Textbook of Electrical Technology, Vol.1&2,S.Chand.

This course can be opted as an elective by the students of the following subjects:

Open to all

Suggested Continuous Evaluation Methods (Max. Marks: 25)

S.No.	Assessment Type	Max. Marks
1.	Mid Term Exam/Test	15
2.	Assignment/Presentation	10

Course prerequisites: M.Sc. in Physics I Semester

B010806P: Physics Lab-II	
Sr.no.	**A. List of Experiments**
1.	To determine laser beam parameter
2.	Characteristics of Solar cell
3.	Study of Hall's effect in a given semiconductor
4.	Resistivity measurement of a semiconductor by Four – Probe method
5.	Determination of e/m by Millikan's Oil drop method
	B. Industrial Training / Field visit
	Marks Distribution
1.	ETE: One practical – 50
2.	CTE: Practical record (20) + Field Visit (30) = 50
B010807P : Electronics Lab-II	
Sr.no.	**A. List of Experiments**
1.	Study of Op-amp - Basic operational circuits
2.	AA stable and mono stable multi vibrators using IC 555
3.	Characteristics of SCR
4.	Characteristics of LDR
5.	Up/down counter using mod10
	B. Industrial Training / Field visit
	Marks Distribution
1.	ETE: One practical – 50
2.	CTE: Practical record (20) + Field Visit (30) = 50

M.Sc. (SEMESTER-III) PAPER-I		
PROGRAMME: CLASS: M.Sc.	**YEAR: II**	**SEMESTER: III**
SUBJECT: PHYSICS		
COURSE CODE: B010901T	**COURSE TITLE: Nuclear Physics**	
Credits: 5	**Core**	
Max. Marks: 25+75	**Min. Passing Marks:**	

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:

Unit	Topics	No. of Lectures
I	**Binding Energy:** Basic properties of nuclei, nuclear stability **Nuclear Forces:** Ground state of deuteron, n-p scattering, analysis by method of partial wave, effective range theory, p-p scattering, charge independence and charge symmetry. Non central forces, exchange forces, isospin and charge independence, Pion theory of nucleon forces (elementary treatment).	
II	**Nuclear Models:** Liquid drop model, Shell model, Magic numbers, magnetic moments and Schmidt lines, Collective model (qualitative discussion). Nuclear reactions: Concept of scattering and absorption cross sections, Partial wave analysis, Optical theorem, Compound nucleus, Breit-Wigner formula, Direct reaction, kinematics of nuclear reactions.	
III	**Nuclear Decay:** α-decay and Geiger-Muller law, Gammow's theory, β-decay – parity violation, selection rules, Fermi theory, Fermy-Curie plots, Comparative half-life, -decay-multipole radiation, selection rules, photo disintegration of deuteron.	
IV	**Particle Physics:** Concept of elementary particles, Leptons an Baryons, Basic idea of fundamental interactions in nature, classification, conservative laws, Invariance associated production, strange particles, Quark model, Gell-Mann-Nishijima formula, symmetry transformation.	

Suggested Readings:

1. Atomic & Nuclear Physics- S N Ghosal
2. Nuclear Physics- D C Tayal
3. Nuclear Physics- Roy and Nigam
4. Nuclear Physics- Berkhum
5. Nuclear and Particle Physics- E B Paul

This course can be opted as an elective by the students of the following subjects: Open to all

Suggested Continuous Evaluation Methods (Max. Marks: 25)

S. No.	Assessment Type	Max. Marks
1.	Mid Term Exam/Test	**15**
2.	Assignment/Presentation	**10**

Course prerequisites: M.Sc. in Physics II Semester

M.Sc. (SEMESTER-III) PAPER-II		
PROGRAMME: CLASS: M.Sc.	**YEAR: II**	**SEMESTER: III**
SUBJECT: PHYSICS		
COURSE CODE: B010902T	**COURSE TITLE: Atomic and Molecular Spectroscopy**	
Credits: 5	**Core**	
Max. Marks: 25+75	**Min. Passing Marks:**	

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:

Unit	Topics	No. of Lectures
I	Reduced mass, fine structure of hydrogen atom, Spectra of alkali elements, singlet and triplet states of He.	
II	Spin-orbit interaction, L-S and J-J coupling, Lande g-factor for L-S coupling, Lande interval rules, selection rules, Intensity relations, Zeeman (Normal and anomalous), Paschen back and stark effects, hyperfine structure and isotopic shift, Lamb shift.	
III	Spectra of Diatomic Molecules, Rotational Spectra (rigid rotator and non-rigid rotator model), Vibrational Spectra (harmonic and an harmonic oscillator) Molecular Symmetric Top, Vibrating rotator Isotopic shift.	
IV	Raman Spectra (Quantum mechanical and classical approach) Electronic Spectra-vibrational structure of band system, fine structure of the band systems. Intensity distribution in band systems: Frank Condon principle.	

Suggested Readings:

1. J. M. Brown, Molecular spectroscopy
2. G. M. Barrow, Introduction to Molecular spectroscopy
3. P.F. Bemath, Spectra of Atoms and Molecule
4. B. P. Stranghan and S. Walker, Spectroscopy, Vol I, II and III.
5. G. K. Woodgate, Elementary atomic structure, Claredon Press.
6. Atomic and Molecular Spectroscopy by Raj Kumar, Kedarnath Ramnath Publications.
7. M. Karplus, Atoms and Molecules, Benjamin-Cumming Pub. Co Nuclear and Particle Physics- E B Paul

This course can be opted as an elective by the students of the following subjects: Open to all

Suggested Continuous Evaluation Methods (Max. Marks: 25)

S. No.	Assessment Type	Max. Marks
1.	Mid Term Exam/Test	15
2.	Assignment/Presentation	10

Course prerequisites: M.Sc. in Physics II Semester

M.Sc. (SEMESTER-III) PAPER-III		
PROGRAMME: CLASS: M.Sc.	**YEAR: II**	**SEMESTER: III**
SUBJECT: PHYSICS		
COURSE CODE: B010903T	**COURSE TITLE: Digital Electronics and Microprocessor**	
Credits: 5	**Core**	
Max. Marks: 25+75	**Min. Passing Marks:**	

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:

Unit	Topics	No. of Lectures
I	Number systems, Code (Grey code, ASCII code & BCD code), Basic logic gates, DTL, RTL TTL & ECL logic circuits, Analysis and synthesis of combinational logic circuits, Karnaugh map.	
II	Arithmetic logic circuits, Controlled inverter and adder sub tractor circuits, Data processing circuits, Multiplexers, DE multiplexers, Encoder & Decoder, (1 of 16 decoder, BCD decoder & LED decoder)	
III	Introduction to FF, R-S, D, T, J-K and J-K master slave FF, Synchronous and asynchronous counters, Mode counters, Ring counter, Serial and parallel shift registers. Introduction to semiconductor memories, RAM, ROM, EPROM and their addressing techniques, A/D and D/A converter, 555 timer and its application as mono stable , a stable and multi vibrator.	
IV	Introduction to microprocessor, Architecture of 8085 system components, Control signal of 8085, System timing diagram, Memory R/W cycle, instruction set of 8085, Addressing modes, Elementary programming, concept of 8085 M.P. Data transfer scheme in microprocessor, Memory mapped I/O and I/O mapped, I/O scheme synchronous, Asynchronous & interrupts driven schemes, Hardware and software interrupts of 8085, Concept of memory & I/O interfacing of DMA, Controller.	

Suggested Readings:

1. Digital principle and application- Malvino and Leach
2. Modern digital electronics- R P Jain
3. Microprocessor- Gaonkar
4. Microprocessor and interfacing- Douglas Hall
5. Microprocessor and Microcontrollers by B. Ram, Dhanpat Rai Publication

This course can be opted as an elective by the students of the following subjects: Open to all

Suggested Continuous Evaluation Methods (Max. Marks: 25)

S.No.	Assessment Type	Max. Marks
1.	Mid Term Exam/Test	15
2.	Assignment/Presentation	10

Course prerequisites: M.Sc. in Physics II Semester

M.Sc. (SEMESTER-III) PAPER-IV		
PROGRAMME: CLASS: M.Sc.	**YEAR: II**	**SEMESTER: III**
SUBJECT: PHYSICS		
COURSE CODE: B010904T	**COURSE TITLE: Statistical Physics**	
Credits: 5	**Elective**	
Max. Marks: 25+75	**Min. Passing Marks:**	

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:

Unit	Topics	No. of Lectures
I	**Introduction to statistical physics:** phase space and phase space trajectory, concept of a statistical ensemble, distribution function, and mean value of a physical quantity, statistical equilibrium, statistical independence and quasi-closed systems. Liouville's theorem (no derivation) and its significance, thermodynamic potential: Helmholtz and Gibb's potentials, first and second order phase transitions	
II	**Ensemble Theory:** Concept of ensembles: micro canonical, canonical and grand canonical ensembles. Micro canonical distribution in classical statistics. Gibb's canonical distribution. Partition function, grand canonical distribution, free energy and equation of state of an ideal gas, chemical potential of a monoatomic ideal gas. Statistical distribution in quantum statistics	
III	**Quantum statistics:** Fermi-Dirac and Bose-Einstein distribution, F-D and B.E gases of elementary particles. The electron gas in metals, Degenerate electron gas-equation of state, degeneracy temperature, specific heat. Degenerate Bose Gas, Specific heat and pressure, B-E condensation, I sing model, Diffusion equation	
IV	**Fluctuations:** Fluctuations in ensemble, correlation of space-time dependent fluctuations, fluctuations and transport phenomenon, Brownian motion, Langevin theory, fluctuation dissipation theorem, Fokker-Plank equation.	

Suggesting Reading-

1. F. Reif, Fundamentals of Statistical and Thermal Physics
2. K. Huang, Statistical Mechanics
3. R.K. Patharia, Statistical Mechanics
4. D.A. McQuarrie, Statistical Mechanics
5. S.K. Ma, Statistical Mechanics

This course can be opted as an elective by the students of the following subjects: Open to all

Suggested Continuous Evaluation Methods (Max. Marks: 25)

S. No.	Assessment Type	Max. Marks
1.	Mid Term Exam/Test	**15**
2.	Assignment/Presentation	**10**

Course prerequisites: M.Sc. in Physics II Semester

M.Sc. (SEMESTER-III) PAPER-V

PROGRAMME: CLASS: M.Sc.	YEAR:	SEMESTER: III
SUBJECT: PHYSICS		
COURSE CODE: B010905T	COURSE TITLE: RENEWABLE ENERGY RESOURCES	

Credits: 5	Elective
Max. Marks: 25+75	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:

Unit	Topics	No. of Lectures
I	Conventional Energy Sources, Non-Conventional Energy Sources, Renewable Energy Potential. **Solar Energy:** Solar radiation Availability, Instruments for measurement of Solar Radiation, Solar angles, Atmospheric phenomena, Solar Collectors (FPC, ETC and PTC), Solar thermal and PV applications: water heating application, Solar Dryer, Solar distillation, Solar refrigeration and Fundamental of Photovoltaic.	
II	**Hydropower Energy:** Magneto-hydro-dynamic (MHD) system, Ocean thermal energy conversion (OTEC), Tidal energy conversion, Spring and neap tides, Single and double basin system, Geothermal Energy, Types of geothermal energy sites, Geothermal power plants.,	
III	**Bio-Energy:** Biomass availability, Technologies for Bioenergy conversion, Global and Indian Bio Energy Potential, Nuclear Energy.	
IV	**Wind Energy:** Fundamental of Wind Energy, Indian Wind Energy Potential, Types of wind turbine, Characteristics of the wind, Wind speed monitoring instruments and applications.	

Suggesting Reading-

1. Twidell& A. W. Wier, Renewable energy resources, English Language book, Society I E & F N Spon (1986)
2. N. K. Bansal, M. Kleeman& M. Mielee, Renewable Conversion Technology, Tata McGraw Hill, New Delhi
3. T. John and W. Tony, Renewable Energy Resources, Taylor & Francis.

This course can be opted as an elective by the students of the following subjects: Open to all

Suggested Continuous Evaluation Methods (Max. Marks: 25)

S. No.	Assessment Type	Max. Marks
1.	Mid Term Exam/Test	15
2.	Assignment/Presentation	10

Course prerequisites: M.Sc. in Physics II Semester

B010906P: Physics Lab-III	
Sr.no.	**A. List of Experiments**
1.	To study Zeeman effect and to determine the splitting of spectral lines
2.	G.M. Counter - Absorption coefficient
3.	To determine paramagnetic susceptibility of given material (solution)
4.	Study of Iodine absorption spectrum
5.	Study of Mercury spectrum using Grating Spectrometer
	B. Project Presentation / Seminar on an assigned topic
	Marks Distribution
1.	ETE: One practical – 50
2.	CTE: Practical record (20) + Field Visit (30) = 50
B010907P: Electronics Lab-III	
Sr.no.	**A. List of Experiments**
1.	Study and Verification of Basic and Universal gates
2.	Design & Implementation of half and full adder using XOR & NAND gates
3.	Realization of SR, JK, D and T flip-flops
4.	Design and implementation of comparator using logic gates and IC 7485
5.	Characteristics of P-N junction diode as an voltage regulator
	B. Project Presentation / Seminar on an assigned topic
	Marks Distribution
1.	ETE: One practical – 50
2.	CTE: Practical record (20) + Field Visit (30) = 50

M.Sc. (SEMESTER-IV) PAPER-I

Programme: Class: M.Sc.	Year:	Semester: IV
Subject: PHYSICS		
Course Code: B011001T	**Course Title:** Condensed Matter Physics	
Credits: 5	**Core**	
Max. Marks: 25+75	**Min. Passing Marks:**	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:		

Unit	Topics	No. of Lectures
	Condensed Matter Physics	
I	**Lattice Dynamics:** Central and non-central forces, Generalized force constants, Harmonic approximation, three-dimensional lattice, Dielectric constants, source of polarizability and Clausius-Mossoti relation.	
II	**Electron Band Theory:** Bloch theorem, one electron band theories, plane wave like localized wave functions, nearly free electron approximation, linear combination of atomic orbitals (LCAO) method, tight binding approximation, Kronig Penney model.	
III	**Superconductivity:** Persistent current, Meissner effect, Isotopic effect, Type-I and type-II superconductors, electronic specific heat, London's equation, Cooper pairs, elementary idea about BCS theory, Ground state energy, Superconducting tunneling, Josephson effect.	
IV	**Magnetism:** Para-magnetism, molecular field theory of ferromagnetism, exchange interaction between spins, ferromagnetic and anti-ferromagnetic order, neutron diffraction method to obtain magnetic order in ferromagnetic and anti-ferromagnetic cases of ferroelectricity. **Lattice defect:** Point defect, Frenkel and Schottky defect, color centers, number of defects (vacancies) in equilibrium, dislocation edge and screw, Burger vector, role of dislocation in material strength and crystal growth.	

Suggesting Reading-

1. Solid State Physics- C. Kittle
2. Quantum theory of Solids- C Kittle
3. Theoretical Solid-State Physics- Wuang
4. Solid State Physics- S O Pillai
5. Mossbauer effect and its application – V G Bhinde
6. Semiconductor Physics- S M Sze
7. Solid State Physics by R.K. Puri and V.K.Bubber

This course can be opted as an elective by the students of the following subjects:

Open to all

Suggested Continuous Evaluation Methods (Max. Marks: 25)

S.No.	Assessment Type	Max. Marks
1.	Mid Term Exam/Test	15
2.	Assignment/Presentation	10

Course prerequisites: M.Sc. in Physics III Semester

M.Sc. (SEMESTER-IV) PAPER-II

Programme: Class: M.Sc.	Year:	Semester: IV
Subject: PHYSICS		
Course Code: B011002T	Course Title: Communication and Microwave Electronics	
Credits: 5	Core	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:		

Unit	Topics	No. of Lectures
	Communication and Microwave Electronics	
I	**Analog and Digital Communication:** Different type of modulation, Amplitude modulation, Depth of modulation, Frequency spectrum, square law modulation, Balanced modulator, DSBSC modulation, SSB modulation, Frequency modulation, Reactance tube modulation, Detection of AM and FM waves, linear diode detector, Foster- Shelley discriminator and ratio detector, Fundamentals of PAM, PAW & PPM.	
II	**Microwave Devices:** Klystron, Reflex-Klystron, Principles of operation of Magnetrons, traveling wave tubes, Gunn diode. **Microwave Communication:** Advantages and disadvantages of microwave transmission lines in free space, Propagation of microwaves, Atmospheric effects on propagation, Antennas used in microwave communication.	
III	**Radio and Television Receivers:** TRF and super heterodyne receiver, block diagram of B & W T.V., Transmitter and receiver. **Satellite Communication:** Fundamental principle of satellite communication, Communication satellite link design, Satellite orbit inclination, basic elements of RADAR system.	
IV	**Optical Communication:** Introduction to optical fiber, ray transmission step index, Grounded index, Single mode and multi-mode, Fundamental of LED optical propagation theory, basic idea of optical detectors.	

Suggesting Reading-

1. Principle of Communication- Taub& Shelling
2. Communication System- S. Haykins
3. Communication System- Kennedy
4. Satellite Communication- D.C. Agrawal
5. Microwave Devices – Liao
6. Optical Fibre Communication- G. Keiser
7. Fibre Optics Communication & Practice- J M Senior

This course can be opted as an elective by the students of the following subjects:

Open to all

Suggested Continuous Evaluation Methods (Max. Marks: 25)

S.No.	Assessment Type	Max. Marks
1.	Mid Term Exam/Test	15
2.	Assignment/Presentation	10

Course prerequisites: M.Sc. in Physics III Semester

B011003P: Electronics Lab-IV	
Sr.no.	**A. List of Experiments**
1.	Co-efficient of linear expansion - Air wedge method
2.	Susceptibility of a liquid by Quincke's method
3.	B-H curve using CRO
4.	Study of Electron Spin Resonance in crystals and determination of 'g' factor
5.	Determination of bulk modulus of a liquid using ultrasonic interferometer
	B. Industrial Training / Field visit
	Marks Distribution
1.	ETE: One practical – 50
2.	CTE: Practical record (20) + Field Visit (30) = 50
B011004P: Electronics Lab-IV	
Sr.no.	**A. List of Experiments**
1.	Design and study of amplitude modulation and demodulation circuits
2.	Design and study of pulse width modulation and demodulation circuits
3.	Waveform analysis using storage CRO
4.	Study of reflex klystron characteristics
5.	Study of Gunn diode characteristics and PIN modulator
	B. Industrial Training / Field visit
	Marks Distribution
1.	ETE: One practical – 50
2.	CTE: Practical record (20) + Field Visit (30) = 50

B011005P: Major Research Project/ Dissertation
The concept of introducing the project will help the student community to learn and apply the principles of Physics and explore the new research avenues. In the course of the project the student will refer books, Journals or collect literature / data by the way of visiting research institutes/ industries. He/she may even do experimental /theoretical work in his/her college and submit a dissertation report with a minimum of 40 pages not exceeding 50 pages.
Format for Preparation of Dissertation
The sequence in which the dissertation should be arranged and bound should be as follows: **1.** Cover Page and Title Page **2.** Declaration **3.** Certificate **4.** Abstract (not exceeding one page) **5.** Acknowledgement (not exceeding one page) **6.** Contents (12 Font size, Times new Roman with double line spacing) **7.** List of Figures/ Exhibits/Charts **8.** List of tables **9.** Symbols and notations **10.** Chapters **11.** References