Revised Syllabus for M.Sc. IInd to M.Sc. Vth year
Applied Physic Department

M.Sc. Year I (Semester-I)										
Sr. No.	Course Code	Course	Teaching Scheme (Hours)			Credits	Examination Scheme			Total Marks
			L	T	P		Theory	Tutorial	Practical	
1	MA 101 S1	Mathematics – I	3	1	0	4	100	25	00	125
2	PH 102 S1/S2	Mechanics, Lasers and Fiber Optics	3	0	2	4	100	0	50	150
3	CY 104 S1/S2	Chemistry-I	3	0	2	4	100	00	50	150
4	CEME 105 S1	Engineering Drawing	2	0	4	4	00	00	100	100
5	CEME 105 S1/S2	Energy & Environmental Engineering	3	0	2	4	100	00	50	150
6	PHPH 101 S1	Branch Specific Course I	3	1	2	5	100	25	50	175
7	HU 107 S1/S2	Holistic Empowerment and Human Values	3	0	0	3	100	0	0	100
		Total	**20**	**2**	**12**	**28**	**600**	**50**	**300**	**950**
									Total Lecture Hours	**34**
									Total Credits	**28**

M.Sc. Year I (Semester-II)											
Sr. No.	Course Code	Course	Teaching Scheme			Credits	Examination Scheme			Total Marks
			L	T	P		Theory	Tutorial	Practical	
1	MA 114 S2	Mathematics – II	3	1	0	4	100	25	0	125
2	PH 113 S2/S1	Physics of Materials and Nuclei	4	0	0	4	100	0	0	100
3	AM 108 S2/S1	Engineering Mechanics	3	0	2	4	100	0	50	150
4	CS 109 S2/S1	Fundamentals of Computers and Programming	3	0	2	4	100	0	50	150
5	HU 110 S2/S1	English & Professional Communication	3	0	0	3	100	0	0	100
6	PHPH 102 S2	Branch Specific Course II	3	1	2	5	100	25	50	175
7	ME 111 S2/S1	Workshop Practice	0	0	4	2	0	0	50	50
		Total	**19**	**2**	**10**	**26**	**600**	**50**	**200**	**850**
									Total Lecture Hours	**31**
									Total Credits	**26**

First year of Five Years Integrated M.Sc. (Physics)
M.Sc. – I, Semester – I

Mechanics, Lasers and Fiber Optics

L	T	P	Credit
03	00	02	04

PH 102 S1

1. Course Outcomes (COs):

At the end of the semester students will be able to:

CO1	Infer the concept of D'Alembert, Lagrangian and Hamiltonian classical mechanics
CO2	Explain the origin of quantum mechanics to Schrodinger' equation for particles in box
CO3	Classify the Maxwell's electromagnetic equations and classify the polarized light
CO4	Interpret the concept of Lasers and understand the working of various types of lasers
CO5	Relate the concept of fiber optics and knowing the application of it

2. Syllabus

- **CLASSICAL MECHANICS** **(10 Hours)**
  Constraints,GeneralizedCoordinates,Velocitiesandmomenta,D'Alembert'sPrinciple,Lagrange'sequationofmotion,Planetorbits,Virialtheorem,Calculusofvariations,Variational technique form any independent variables, Hamilton principle, Hamilton's canonical equation of motion, Physical significance of H Advantage of Hamilton approach.

- **QUANTUM MECHANICS** **(10 Hours)**
  Inadequacy of classical mechanics (black body radiation, photoelectric effect), Wave and particle duality of radiation, de Broglie concept of matter waves, Electron diffraction, Heisenberg's uncertainty principle, Schrodinger's wave equation, Eigen values and Eigen functions, Superposition principle ,Interpretation of wave function, Particle confined in one dimensional infinite potential box.

- **ELECTRODYNAMICS** **(06 Hours)**
  Electromagnetic waves, Maxwell's equations in vacuum &medium, Types of polarization, Internal field and Claussius-Mosotti equation

- **LASERS** **(08 Hours)**
  Introduction to Laser, Characteristics of Lasers, Spontaneous and stimulated emissions, Einstein's coefficients, Population inversion and lasing action, Laser systems: Ruby laser, HeNeLaser, Semiconductor Laser, Advanced lasers, Holography.

- **FIBER OPTICS** **(08 Hours)**
  Fermat's principle and Snell's law-optical fiber, Principle and construction, Acceptance one, Numerical aperture, V Number, Types of fibers, Fabrication: Double Crucible Technique, Vapor phase Oxidation Process, Fiber optic communication principle, Fiber optic sensors, Other applications of optical fibers.

(Total Lecture Hours: 42 Hours)

3. BOOKS RECOMMENDED:

1. R.ResnickandD.Halliday Physics(PartI&II)Wiley, 2007
2. A.BeiserConceptoftheModernPhysicsMcGraw-Hill, 2008
3. Landauand Lipschitz MechanicsButterworth-Heinemann,1982
4. D.J.GriffithsIntroductiontoElectrodynamicsAddison-Wesley,2012
5. W.T. Silfvast,LaserFundamentals,Cambridge, 2004

First year of Five Years Integrated M.Sc.(Physics)
M.Sc. – I, Semester – I

Introduction to Classical Mechanics

L	T	P	Credit
03	01	02	05

PHPH 101 S1

1.Course Outcomes (COs):

At the end of the semester students will be able to:

CO1	Infer the fundamentals of vectors and co-ordinate system
CO2	Define basic concept of various laws of motions and moment of inertia
CO3	Explain Euler's concept on rigid body motion
CO4	Interpret elastic properties of materials and Rephrase the concept of hydrodynamics
CO5	Analyze application of simple harmonic motions
CO6	Classify the different oscillations and summarize it in resonance

2.Syllabus

- **VECTORS FUNDAMENTALS AND DIFFERENT CO-ORDINATE SYSTEM(08 Hours)**
  Unit vectors, Vector operations, Tripple products, Vector algebra in component form, differential calculus, Cartesian coordinate system, Spherical coordinate system, Cylindrical coordinate system.

- **NEWTON'S LAWS OF MOTION,CONSERVATION LAWS,MOMENTS OF INERTIA (08 Hours)**
  Mechanics of the particle, Equation of motion, Different conservation laws, Moments of inertia, Motion in central force field.

- **RIGID BODY MOTION (06 Hours)**
  Euler's theorem, Angular momentum and kinetic energy, Euler's equation of motion, Euler's angles.

- **ELASTICITY &HYDRODYNAMICS (08 Hours)**
  Stress and Strain, Young's modulus, Shear modulus and Bulk Modulus, Buoyancy, Types of fluid flow, Bernoulli's equations, Viscocity, Terminal Velocity.

- **SIMPLE HARMONIC MOTION (04 Hours)**
  Restoring force, Elastic potential energy, Period and frequency, Energy, Pendulums, Applications of SHM.

- **OSCILLATIONS (08 Hours)**
  Damped oscillations, forced oscillations, coupled oscillations & resonance.

(Total Lecture Hours: 42 Hours)

3. BOOKS RECOMMENDED:

1. D. S.Mathur,Mechanics,S.Chand& Company, 2000.
2. R.G.Takwale&P.S.Puranik, Introductionto ClassicalMechanics,Tata McGraw-Hill Book Co, 1997.
3. R.P.Feymann,R.B. LightonandM.Sands,TheFeynmanLecturesinPhysicsVol.1,NarosaPublishers, 2008.
4. H. C.Verma,Concepts ofPhysics,Vol. 1 &2, BharatiBhavan, 2007.
5. L. D. Landau& E. M. Lifshitz,CourseonTheoreticalPhysics,Vol.1: Mechanics,Addison-Wesley,2002

First year of Five Years Integrated M.Sc.(Physics)
M.Sc. – I, Semester – II

Physics of Materials and Nuclei

L	T	P	Credit
04	00	00	04

PH 113 S2/S1

1.Course Outcomes (COs):

At the end of the semester students will be able to:

CO1	Define the concept of basic crystallography
CO2	Interpret the importance of the semiconductors and find the parameters of it by Hall effects experiments
CO3	Explain the properties, synthesis types and application of nanomaterial
CO4	Give brief outline of magnetic materials and classify between conductor and superconductors
CO5	Understand the fundamental of statistical mechanics
CO6	Rephrase the nuclear properties and classify the elementary particles

2. Syllabus

- **CRYSTALLOGRAPHY (10 Hours)**
  Crystalline and amorphous solids, Lattice and unit cell, Seven crystal system and Bravais lattices, Symmetry operation, Miller indices, Atomic radius, Coordination number, Packing factor calculation for SC, BCC, FCC, Bragg's law of X-ray diffraction, Laue Method, Powder crystal method.

- **SEMICONDUCTOR PHYSICS (06 Hours)**
  Introduction, Direct and indirect bandgap semiconductors, Intrinsic and extrinsic semiconductors, Law of Massaction, Charge neutrality, Hall Effect.

- **NANOMATERIALS (10 Hours)**
  Introduction and properties, Synthesis: Chemical vapor deposition, Ball milling and relevant applications, Carbon nanotubes: structure and properties and Synthesis: Arc method and Pulsed laser deposition, Applications.

- **MAGNETIC MATERIALS,CONDUCTORS AND SUPERCONDUCTORS (10 Hours)**
  Magnetic materials: Definition of terms, Classification of magnetic materials and properties, Domain theory of ferromagnetism, Hard and soft magnetic materials, Conductors: Classical free electron theory (Lorentz–Drude theory), Electrical conductivity, Super conductors: Definition, Meissner effect, Type I &II superconductors.

- **STATISTICAL MECHANICS (10 Hours)**
  Macroscopic and microscopic states, Phase space, Condition for statistical equilibrium, Micro-canonical ensemble, canonical ensemble, Grand-canonical ensemble, Partition function, Bose-Einstein and Fermi-Dirac distribution.

- **NUCLEAR AND PARTICLE PHYSICS (10 Hours)**
  Nuclear properties and forces, Nuclear models, Shell model, Nuclear reaction, Radioactivity, Types and half-lives, Application in determining the age of rock and fossils, Stellar nucleo synthesis, Fundamental forces, Particle physics, Classification of matter, Quark model, Neutrino properties and their detection.

(Total Lecture Hours: 56 Hours)

3. BOOKS RECOMMENDED:

1. R. Resnick and D. Halliday,Physics (Part I &II),Wiley,2007.
2. A. Beiser,Concept of the Modern Physics, McGraw-Hill, 2008.
3. K. Huang,Statistical mechanics,Willey,2008.
4. M. N. Avadhanulu and P. G. Kshirsagar, A text book of Engineering Physics, S Chand, 2009.
5. C. Kittel, Introduction to Solid State Physics, Wiley, 2016.

Additional Books:

1. K. K. Chattopadhyay and A. N. Banerjee,Nanoscience andNanotechnology,PHI, 2014.

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First year of Five Years Integrated M.Sc.(Physics)
M.Sc. – I, Semester – II

PHPH 102 S2:Kinetic Theory and Thermodynamics

L	T	P	C
03	01	02	05

1. Course Outcomes (COs):

At the end of the semester students will be able to:

CO1	Interpret the fundamental concept of kinetic theory of gases
CO2	Compare properties of ideal gas and real Van der wall's gas state
CO3	Explain fundamental of thermodynamics laws and thermodynamic processes
CO4	Extend knowledge about Maxwell's thermodynamics relations and thermodynamic potentials
CO5	Classify the classical and quantum statistics distributions
CO6	Explain black body radiation in thermodynamics point of view

2. Syllabus

- **KINETICTHEORYOFGASES(04 Hours)**
  Postulates of kinetic theory of gases, velocity of gas molecules, Molecular energy, Kinetic-molecular model of an ideal-gas, kinetic interpretation of temperature, Degree of freedom of gas molecules, Maxwell's law of equi partition of energy.

- **INTERMOLECULAR FORCES&TRANSPORTPHENOMENA (04 Hours)**
  Viscosity of a gas, Thermal conductivity of gases, Vanderwall's equation of state, Brownian motion.

- **LAWSOFTHERMODYNAMICS(12 Hours)**
  Zeroth law of Thermodynamics, Iand IIlaws of Thermodynamics, Concepts of temperature, Internal energy and entropy, Calculations of change of internal energy and entropy in various thermodynamic processes.

- **THERMODYNAMICPOTENTIALS,HELMOLTZ&GIBBSFUNCTIONS,MAXWELLRELATIONS (10 Hours)**
  Gibbs and Helmholtz energy, Gibbs paradox, Enthalpy, Maxwell's thermodynamic relations.

- **ELEMENTS OFSTATISTICALPHYSICS (08 Hours)**
  Fermi Dirac, Maxwell Boltzmann and Bose Einstein distributions.

- **THERMODYNAMICS OFBLACKBODIES(04 Hours)**
  Black body and characteristics, Radiation principles like Rayleigh Jeans, Weinsand Planck's law of black body radiation.

(Total Lecture Hours: 42 Hours)

3.BOOKS RECOMMENDED:

1. F.W. Sears&Salingar,Thermodynamics,Kinetictheoryand StaticalThermodynamics, 3rd Edition. Addison-Wesley/Pearson, 1975
2. Young&Freedman, Searsand Zemansky'sUniversityPhysics, PearsonEducation, Singapore, 2004
3. R. P.Feymann. R.B.Leightonand M. Sands,The FeymannLecturesinPhysics,Vol.1Narosa Publishers, 2008
4. ZemanaskyM. W., HeatandThermodynamics,(McGrawHill),1957
5. CarterA.,ClassicalandStatisticalThermodynamics,PearsonEducation, 1999.

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