Programme:- B.Sc Physics
(2011 Admission onwards)

Graduate Programme Outcomes

GPO No.	Graduate Programme Outcomes
GPO No. 1	**Disciplinary Knowledge & Critical Thinking:** Articulate knowledge of one or more disciplines that form a part of UG programme. Critically think, analyse, apply and evaluate various information and follow scientific approach to the development of knowledge.
GPO No. 2	**Communication Skill:** Communicate thoughts and ideas clearly in writing and orally. Develop careful listening, logical thinking and proficiency in interpersonal communication.
GPO No. 3	**Environmental Awareness:** Sustainable approach to use of natural resources. Capable of addressing issues, promoting values and give up practices that harm the ecosystem and our planet.
GPO No. 4	**Ethical Awareness:** Uphold ethics/morals in all spheres of life. Identify and avoid unethical behaviour in all aspects of work.
GPO No. 5	**Social Commitment:** Be aware of individual roles in society as nation builders, contributing to the betterment of society. Foster social skills to value fellow beings and be aware of one's responsibilities as international citizens.
GPO No. 6	**Lifelong learners:** Equip students to be life long learners. Be flexible to take up the changing demands of work place as well as for personal spheres of activities.

PSO. No.	Programme Specific Outcome (PSO)	GPO
1.	Understand basic concepts of different branches of Physics like, thermodynamics, Classical and Quantum Mechanics, and electrodynamics.	1
2.	Apply the principles of Physics in day to day life.	1,3,6
3.	Develop the expertise in operating different electrical, electronic, optical, and mechanical instruments.	1,6
4.	Develop the skills in performing, analyzing and documenting laboratory experiments.	1,2,6
5.	Develop analytical thinking and problem solving skills.	1,2,5,6
6.	Equip students for their future careers by inculcating the	2,4,5,6

	qualities of accuracy, clarity of thought and expression, and systematic approach.	
7.	Develop awareness regarding the need for eco-friendly and sustainable technological use.	3,4,5,6

Course Outcome

1. Semester I (Core)

PH1B01U – Methodology in Physics

Sl.No.	Course Outcome	Cognitive Level	PSO
1.	Recognize the contributions of scientists in Physics.	Remember	1
2.	Appreciate the inventions and discoveries in Physics.	Understand	1
3.	Understand the historical evolution of measuring and instruments	Understand	1
4.	Understand measurement devices for time, length, angle, electrical values etc.	Understand	1
5.	Apply the knowledge of error and precision to check the accuracy of measuring instruments.	Evaluate	4,5,6

Course Description

Sl. No.	Course description	Hrs.	CO
1.0	**Historical perspective on Physics and its method**	12	1
1.1	Ancient perspectives on the universe - Geocentric model of Ptolemy – Copernican revolution. Galileo, and his emphasis on experiments and observations. Kepler's laws.	3	1
1.2	Newton and the deterministic universe - Maxwell and the unification of electricity, magnetism and optics.	2	1
1.3	Planck's hypothesis of quantum. Quantum mechanics. Einstein and his theories of relativity. Contributions by S. N. Bose, M. N. Saha, C. V. Raman and S. Chandrasekhar.	2	1
1.4	Emergence of modern physics and technology - Semiconductor revolution - nanotechnology.	1	1
1.5	Contemporary worldview - the expanding universe – fundamental particles and the unification of all forces of nature. (All from a historical perspective – details and	1	1

	derivations not required)		
1.6	Physics, and its relation to other branches of Science. Hypotheses; theories and laws in science- verification (proving), corroboration and falsification (disproving), Revision of scientific theories and laws. Significance of Peer Review. Publications and patents.	3	1
2.0	**Measuring instruments**	**12**	1, 3,4
2.1	Measurement of time – water clocks – sun dials pendulum clocks – digital clocks – atomic clocks.	3	1, 3
2.2	Length measurement – rulers – standard metre micrometers – screw gauges-travelling microscope – laser range finder- sonar – GPS.	3	1, 3,
2.3	Angle measurement – spectrometer verniers - scale and telescope - measurement of stellar parallaxes .	3	1, 3,4
2.4	Electrical measurement - Working principle of galvanometer, voltmeter, ammeter and digital multimeters.	3	1, 4
3.0	**Error analysis**	**12**	5
3.1	Basic ideas – uncertainties of measurement – importance of estimating errors – dominant errors	3	5
3.2	Random errors – systematic errors - rejection of spurious measurements	2	5
3.3	Estimating and reporting errors – errors with reading scales, errors of digital instruments	1	5
3.4	Number of significant digits –absolute and relative errors – standard deviation – error bars and graphical representation.	2	5
3.5	Propagation of errors – sum and differences – products and quotients – multiplyingby constants – powers	2	5
3.6	Calibration – need for calibration – methods of calibration.	2	5

References:

1. Feynman lectures of Physics
2. Concepts of Modern Physicssss, Arther Beisser
3. Modern Physics, Kenneth Krane
4. Modern Physics, R Murugeshan
5. Introduction to Electrodynamics, David J. Griffiths
6. Advanced course in Practical Physics, D Chattopadhyay

2. Semester II (Core)
PH2B01U –Mechanics and Properties of Matter

Sl.No.	Course Outcome	Cognitive Level	PSO
1.	Identify different types of motion.	Understand	1, 2,5
2.	Develop knowledge and understanding of Waves and oscillations	Understand	1,2,5
3.	Understand the dynamics of different types of pendulum.	Understand	1,5
4.	Determine moment of inertia of symmetrical rigid bodies based on parallel and perpendicular axes theorem	Apply	1,5
5.	Understand the elastic behavior of Materials and Differentiate different types of fluid flow.	Understand	1,2,5
6.	Understand the phenomena of surface tension and relate it to daily life.	Understand	2,5

Course Description

Sl. No.	Course description	Hrs.	CO
1.0	**Motion under gravity and Rotational mechanics**	**11**	**1,3,4**
1.1	Velocity- acceleration- force – acceleration due to gravity- weightlessness	2	1
1.2	Compound pendulum (symmetric and unsymmetric) radius of gyration- kater's pendulum- centripetal acceleration and force- centrifugal force	4	3
1.3	Angular velocity- angular acceleration- angular momentum- conservation- torque- moment of inertia-	3	4
1.4	Parallel and perpendicular axes theorem - calculation of momentof inertia- (rod, ring, disc, cylinder, sphere) flywheel.	2	4
2.0	**Oscillation and waves**	**9**	2
2.1	SHM, equation of motion to SHM- theory of damped oscillation (over, under, critical)	3	2
2.2	Theory of forced oscillation- resonance- solution and equation to progressive wave	2	2
2.3	Energy of progressive wave- superposition of waves	2	2
2.4	Theory of beats- Doppler effect.	2	2
3.0	**Elasticity, Viscosity ,Surface tension**	**16**	5, 6

3.1	Stress- strain- Hooke's law- elastic module- Poisson's ratio- bending of beams- bending moment- Young's modulus (cantilever-mirror and telescope)	3	5
3.2	Young's modulus (uniform and non uniform bending-microscope) torsional oscillations	2	5
3.3	Rigidity modulus- static torsion(mirror and telescope)- I section girder.	2	5
3.4	Molecular theory of surface tension- surface energy-excess pressure in a liquid drop	3	5,6
3.5	Transverse waves on the surface of a liquid- effect of gravity- effect of surface tension-	2	6
3.6	Factors affecting surface tension- applications.	2	6
3.7	Streamline and turbulent flow- critical velocity-derivation of Poiseuille's formula- derivation of -Stoke's formula-Lubricants.	3	6

References:

1. Mechanics-D.S. Mathur
2. Mechanics-Hans and Puri, TMH
3. Classical Mechanics by J.C. Upadhyaya, Himalaya Pub
4. Classical Mechanics-Takwale and Puranik, TMH
5. Properties of Matter- Mathur, S. Chand
6. Classical mechanics-K.SankaraRao, PHI

3. Semester III (Core)
PH3B01U: Electronics

Sl. No.	Course Outcome	Cognitive Level	PSO
1	Understand the concepts of semiconducting diodes and its applications	Understand	1
2	Execute the principles of diodes in rectifiers, filters, clippers and clampers.	Apply	1, 2, 3 ,5
3	Understand the concepts of transistor configurations and its application	Understand	1
4	Execute the principle of transistor configuration for the study of oscillators and amplifiers.	Understand, Apply	1, 2, 3 ,5
5	Understand FET,MOSFET, Op-Amp, and modulation	Understand	1
6	Calculate different parameters related to diodes, transistors, oscillators and amplifiers.	Apply	5

Course Description

Module	Course Description	Hrs	CO
1.0	**Basic concepts of semiconductors**	**15**	**1,2,6**
1.1	P-N junction Diode-Diode Characteristics-Expression for Diode current (Expression- without derivation)	2	1
1.2	Static and Dynamic resistances-Junction capacitance-Equivalent circuit-Avalanche and Zener breakdown-PIV. Rectifiers	3	1,2
1.3	Half wave-Centre tapped full wave and Bridge rectifiers-Derivation of efficiency and ripple factor of half wave and full wave rectifiers	2	2
1.4	Filter circuits- Shunt capacitor filter-Series inductor filter-LC filter- π section filter	2	1,6
1.5	Voltage regulation-Line regulation and load regulation- Zener diode shunt regulator	2	1,2,6
1.6	Design of circuit-Optimum value of current limiting resistor. Wave shaping circuits-Clipper-Positive, negative and biased clipping circuits	2	2,6
1.7	Clampers-Biased clampers-Voltage multipliers- Doubler-Tripler & Quadrupler.	2	2,6
2.0	**Transistors**	**18**	**3,4,5,6**
2.1	Transistors-Bipolar junction transistors-Mechanism of amplification in a transistor	2	3
2.2	Common base, common emitter and common collector configurations and their characteristics-Active, saturation and Cut-off regions-Current gain α , β , γ and their relationships	3	3,6
2.3	Experiment to draw the characteristics of transistor in the CB and CE modes	2	3
2.4	Leakage currents-Expressions for output currents in the three modes-Thermal runaway	1	3
2.5	Load line, Q-Point- Classification of amplifiers-Class A,B,AB and C amplifiers	2	3,4 ,6
2.6	Need for biasing-Stabilization-Transistor biasing-Fixed bias-Collector to base bias-Self bias(emitter bias)-Voltage divider bias-Transistor as a switch.	2	4
2.7	AC equivalent circuit using h-parameters-Analysis of a transistor amplifier using h- parameters	2	4,6
2.8	Performance of CE,CC and CC amplifiers	1	4,6
2.9	Basic ideas of FET and MOSFET	3	5
3.0	**AmplifierS**	**21**	**4,5,6**

3.1	Feedback amplifiers-Principle of feedback amplifiers-Positive and negative feedback and its effects - Different types of feedback (Block diagrams only)-Emitter follower.	4	4
3.2	Sinusoidal oscillators-Principle of oscillators-Barkhausen criterion-Tuned collector oscillator-Hartley and Colpitt's Oscillators – RC Phase shift oscillators – Crystal oscillator.	5	4,6
3.3	Operational amplifiers - Ideal Op-amp - Virtual ground and summing point- Applications-Inverting amplifier - Non inverting amplifier-Unity follower – Summing amplifier (adder).	4	5,6
3.4	Modulation and Demodulation -Types of modulation - Amplitude modulation- Percentage modulation-modulation index - Analysis of AM wave – Sidebands – bandwidth - Power in an AM wave-Modulating amplifier circuit.	4	5
3.5	Frequency modulation-Carrier swing-Modulation index-Deviation ratio-Percentage modulation (Basics only)	2	5,6
3.6	Demodulation or detection-Diode detector circuit for AM signals	2	5,6

References:

1. Basic Electronics-B.L.Theraja
2. A Text Book of Applied Electronics-R.S.Sedha
3. Principles of electronics, VK Mehta
4. Basic Electronics(7 th Edition)-Malvino and Bates
5. Electronics Fundamentals and Applications-D. Chattopadhyay and P.G.Rakshit,
6. Electronics: Fundamentals of Analog circuits-Thomas L. Floyd, David Buchla,
7. Electronic Devices and Circuit Theory-Robert Boylestad, Louis Nashelsky
8. Basic Electronics-Debashis De
9. Basic Electronics-Santiram Kal

4. Semester IV
PH4B01U- Electricity and Electrodynamics

Sl.No.	Course Outcome	Cognitive Level	PSO
1.	Understand the difference between resistance and impedance in an a.c circuit.	Understand	1, 2
2.	Understand the concepts of flux, electric field, and magnetic field.	Understand	1, 2
3.	Compute the current and voltage in electrical circuit containing L,C,R.	Apply	2, 5, 6

4.	Simplify complex circuits using network theorems.	Apply	2, 5, 6
5.	Apply the fundamental theorems of curl and divergence in specific situations.	Apply	2, 5, 6
6.	Evaluate the electric field due to symmetric charge distribution by applying Gauss's law.	Apply	5
7.	Understand that Maxwell's equations are the base of electromagnetic theory and propagation of Electromagnetic waves	Understand	5, 6
8.	Apply the Biot-Savart law and Ampere's law to compute magnetic field due to a charge distribution.	Apply	4,5

Course Description

Module	Course Description	Hrs	CO
1.0	**Varying and Alternating Currents.**	**19**	**1,3,4**
1.1	Growth and decay of current in an inductive circuit-charge and discharge of a capacitor through a resistance.	2	1,3
1.2	Measurement of high resistance by capacitor leak method- DC applied to LCR series circuit(charge case)	2	3
1.3	Discharging of capacitor through LR circuit(discharge case)	3	3
1.4	Theory of BG-measurement of K of BG using standard capacitance.	2	1,3
1.5	RMS and peak values-AC through series LCR(acceptor circuit) and parallel LCR circuit(rejecter circuit)	3	3
1.6	Q factor-power in AC-power factor-measurement of power in AC circuit-AC watt meter	4	3
1.7	Distribution of three phase current: star connection – delta connection - Ideal voltage and current sources-Thevenin's and Norton's theorems-Maximum power transfer theorem- Superposition Theorem	3	4
2.0	**Electrostatics, Magnetostatics and Maxwell's equations**	**25**	**2,5,6,7,8**
2.1	Electric field- Continuous charge distribution-Divergence and curl of electrostatic fields.	3	2,5
2.2	Gauss' Law-Applications Fields due to: Spherically symmetric charge distribution, Uniformly charged spherical conductor, Line charge, Infinite plane sheet of charge, Electric field at a point between two oppositely charged parallel plates.	4	6
2.3	Electric potential-Poisson's equation and Laplace's equation, The potential of a localized charge distribution, Work and Energy in electrostatics-The work done to move a charge	4	5,6

2.4	Energy of a point charge distribution and continuous charge distribution, Conductors - Basic properties-induced charges, Surface charge and force on a conductor-Capacitors.	3	6
2.5	Magnetic field of Steady currents - Comparison of magnetostatics and electrostatics	5	5,8
2.6	Maxwell's equations and magnetic charge - Maxwell's equations inside matter	4	7
2.7	Boundary conditions – Scalar and vector potentials –Poynting theorem.	3	8
3.0	**Electromagnetic waves**	**10**	**7**
3.1	Production and Detection of EM Waves- Hertz Experiment- The wave equation in one dimension	3	7
3.2	Plane waves - Polarisation – Boundary conditions- Reflection and transmission	3	7
3.3	Monochromatic plane waves in vacuum - Energy and momentum of electromagnetic waves	2	7
3.4	Propagation through linear media –- Modified wave equation in conductors - Monochromatic plane waves in conducting media.	2	7

References:

1. Introduction to Electrodynamics, David J Griffiths
2. Electricity and Magnetism, R. Murugeshan
3. Fundamentals of Magnetism and Electricity, D.N Vasudeva
4. Electricity and Magnetism, KK Tewari-
5. Principles of Electromagnetics, Mathew N.O Sadiku
6. Classical Electromagnetism, Jerrold Franklin
7. Electromagnetic Fields and Waves, KD Prasad

5. Semester V
PH5B01U: Classical and Quantum Mechanics

Sl No.	Course Outcome	Cognitive Level	PSO No.
1	Understand the advantages of analytical mechanics over Newtonian mechanics and basic formulation of Lagrangian and Hamiltonian methods.	Understand	1
2	Understand the importance of Qunatum Mechanics by the successful explanation of blackbody radiation, photoelectric effect and	Understand	1

	Compton effect where classical thoery failed.		
3	Solve simple systems using Lagrangian and Hamiltonian formulations.	Apply	2,5
4	Understand wave particle duality by illustrating Davisson Germer experiment and de Broglie hypothesis and solve problems	Understand Apply	1,5
5	Understand the basic tools for the formulation of quantum mechanics and the basic equations of quantum mechanics.	Understand	1
6	Summarize that Classical Mechanics and Quantum Mechanics are two different interpretations of same aspects.	Understand	1
7	Apply the quantum mechanical principle for normalising the wave functions and to estimate the values of eigen values and eigen functions.	Apply	5

Course description

Module	**Course description**	**Hrs**	**CO**
1.0	**Lagrangian and Hamiltonian Equations**	**18**	**1,3**
1.1	Constraints and degrees of freedom - Generalized coordinates	2	1
1.2	Classification of a dynamical system – Principle of virtual work – D'Alemberts Principle	3	1
1.3	Lagrange's equations for general systems - Applications – one dimensional harmonic oscillator – planetary motion	4	1,3
1.4	Hamilton's equations of motion – Application - One dimensional harmonic oscillator - Hamilton's Principle for a conservative system	5	1,3
1.5	Principle of least action – Calculus of variations – Lagrange's equation from Hamilton's Principle	4	1,3
2.0	**Emergence of quantum concepts and Time dependent Schrodinger equation**	**17**	**2,4,5**
2.1	Black body radiation - Planck's law - Particle nature of radiation	2	2
2.2	Photoelectric effect - Compton effect - wave nature of matter	3	2
2.3	De Broglie hypothesis – Davisson and Germer experiment	2	4

2.4	Uncertainty principle – probabilistic interpretation of wave function.	2	4
2.5	The Schrodinger equation – Operators - The commutator	3	5
2.6	Physical Interpretation of wave function – Normalisation probability current density	3	5
2.8	Expectation value – General eigen value equation – eigen value for momentum operator.	2	5
3.0	**Propogation of wave packet and Time independent Schrodinger equation**	**19**	**5,6,7**
3.1	General solution of one dimensional Schrodinger equation for a free particle – group velocity and phase velocity.	4	5
3.2	Stationary state - Time independent Schrodinger equation – boundary and continuity condition for wave functions.	3	5,6
3.3	Degeneracy – orthogonality of wave function – particle in a box (one dimensional)	3	6
3.4	One dimensional harmonic oscillator – energy eigen value and zero point energy	3	5,6,7
3.5	Orbital angular momentum – commutation relations	3	6
3.6	Eigen values of L 2 , L z - Energy eigen values of rigid rotator	3	6

References:

1. Textbook of Quantum Mechanics- G Aruldhas.
2. Classical Mechanics by J.C. Upadhyaya. Himalaya Pub.
3. Concepts of Modern Physics- Arthur Beiser, TMH
4. Classical Mechanics by G. Aruldhas
5. Concepts of Modern Physics- Arthur Beiser, TMH
6. A Textbook of Quantum Mechanics- G Aruldhas- (2 nd Edition)- PHI
7. Classical Mechanics-Takwale and Puranik, TMH.

6. Semester V
PH5B02U : PHYSICAL OPTICS AND PHOTONICS

4.

Sl No.	Course Outcome	Cognitive Level	PSO No.
1	Understand the basic idea of optics- interference, diffraction, polarisation.	Understand	1
2	Illustrate the construction and working	Understand	1,3

	of basic optics and laser related equipments.		
3	Apply the basic equations of optics in problem solving.	Apply	2,5
4	Apply the principles of optics in conducting experiments related to optics.	Apply	2,3,4,5
5	Focus on the applications of laser and fibre optics in day today life.	Analyse	6
6	Identify the cause and effects of the basic phenomena of nature based on the principles of optics.	Analyse	7

Course Description

Sl.No	Course Description	Hrs	CO
1.0	**Interference and Diffraction**	**11**	**1,2,3,4,**
1.1	Review of basic ideas of interference, (Coherent waves-Optical path and phase change-superposition of waves, condition for bright and dark fringes).	3	1
1.2	Thin films- plane parallel film-interference due to reflected light-conditions for brightness and darkness	3	1,4
1.3	Interference due to transmitted light-Haidinger fringes-interference in wedge shaped film-colours in thin films-Newton's rings.	3	1,3
1.4	Michelson interferometer- construction-working and applications.	2	2
1.5	Fresnel Diffraction – Huygens- Fresnel theory –zone plate – Difference between zone plate and convex lens.	5	1,3
1.6	Comparison between interference and diffraction –diffraction pattern due to a straight edge, single silt	3	1,3,4,6
1.7	Fraunhoffer diffraction at a single slit, double slit, N slits, theory of plane diffraction grating.	3	1,3
2.0	**Polarisation**	**10**	**1,3**
2.1	Concept of polarization – (plane of polarization)-polarization by reflection-Brewster's law-polarization by refraction-pile of plates. Polarization by double refraction-(calcite crystal).	2	1
2.2	Anisotropic crystals –optic axis –Double refraction-Huygens	2	1,3

	explanation of double refraction. Positive and Negative crystals- Electromagnetic theory of double refraction.		
2.3	Types of polarized light-Retarders or wave plate- Quarter wave plate – Half wave plate- Production and Detection of elliptically and circularly polarized light-	3	1
2.4	Optical Activity-Fresnels Explanation of Optical Rotation-(Analytical treatment not needed) – Specific Rotation-Laurents half shade polarimeter	3	1
3.0	**Laser, Fiber Optics and Optical communication**	**22**	**2,3,4,5,6**
3.1	Absorption and emission of light-Absorption-spontaneous emission and stimulated emission-light amplification by stimulated emission.	3	2
3.2	Einstein's relations-condition for light amplification –population inversion-pumping –pumping methods –optical pumping – electrical pumping -direct conversion	4	2,3
3.3	Active medium-metastable states- pumping schemes (two level, three level and four level) Optical resonator (theory not required) Threshold condition.	2	2
3.4	Types of lasers-ruby laser, He-Ne laser, semi- conductor laser.	2	2
3.5	Applications of lasers-Holography (principle, recording and reconstruction)	1	2
3.6	Optical fibre- Critical angle of propagation-modes of propagation-Acceptance angle.	2	2,4
3.8	Fractional refractive index change- Numerical Aperture- Types of Optical fibers	3	2
3.9	Normalized Frequency- pulse dispersion Attenuation-Applications	2	2
3.10	Fibre optic communication system- Advantages of Optical fibers.	3	2,3,5

References:

1. Optics N.Subramanayam, Brijlal, M.N Avadhanulu S Chand.
2. Optics, 3 rd edition, AjoyGhatak
3. Laser Fundamentals, William T Silfvast
4. Fiber Optics and Optoelectronics, R P Khare, Oxford 2012..
5. Introduction to Optics, Frank L Pedrotti, Leno M Pedrotti& Leno S Pefrotti
6. Semiconductor physics and optoelectronics- V.Rajendran, J.Hemaletha and M.S.M.Gibson

7. Semester V
PH6CRT09 : Thermal and Statistical Physics

Sl. No.	Course Outcome	Cognitive Level	PSO
1	Recall the basic ideas of thermodynamics and to understand the laws of thermodynamics.	Remember, Understand	1
2	Understand the working of heat engine .	Understand	1
3	Explain the concepts of entropy and to derive thermodynamic relations.	Understand	1
4	Understand heat transfer mechanisms and related laws.	Understand	1
5	Apply thermodynamic laws to estimate thermodynamic variables.	Apply	5
6	Understand the basics of statistical mechanics.	Understand	1
7	Distinguish statistical distributions.	Understand	1

Course Description

Module	Course Description	Hrs	CO
1.0	**Thermal Physics**	**18**	**1,2**
1.1	Laws of Thermodynamics: Zeroth law. First law- internal energy, Applications of first law, Indicator diagram,	3	1
1.2	Work done during isothermal and adiabatic process, slopes, relation between them , cooling due to Adiabatic reversible processes .	4	1
1.3	Reversible and irreversible processes, Second law, Heat Engines,	3	2
1.4	Carnot cycle and theorem, Work done by the engine per cycle, efficiency	3	2
1.5	Otto Engine, Petrol engine, Diesel Engine	3	2
1.6	Third law of thermodynamics -Unattainability of absolute zero	2	2
2.0	**Thermodynamic relations and Heat Transmission**	**18**	**3,4,5**
2.1	Entropy, entropy changes in reversible and irreversible processes, Entropy –temperature diagrams and equations.	3	3
2.2	Physical significance of entropy. Clausius Clepeyron Equation.	2	3
2.3	Thermodynamic potentials: Enthalpy, Gibbs and Helmholtz functions	2	3
2.4	Maxwell’s relations and applications,	3	5
2.5	Concepts of adiabatic and isothermal elasticity	3	4
2.6	Modes of heat transfer, Searle’s & Lee’s experiment.	2	4,5
2.7	black body radiation, Stefan- Boltzmann Law,	2	4

2.8	Wein's displacement law, Rayleigh -Jean's Law, Planck's law (no derivation).	1	4
3.0	**Statistical mechanics**	**18**	**6,7**
3.1	Micro and Macro states, thermodynamic probability,	2	6
3.2	energy states, energy levels, degenerate energy levels, degenerate gas,	2	6
3.3	phase space, concept of entropy and thermodynamic probability.	2	6
3.4	Classical Statistics: Maxwell-Boltzmann Distribution law, thermodynamics of an ideal monoatomic gas, Classical entropy expression, Gibbs' paradox.	4	7
3.5	Quantum Statistics:Need of quantum statistics- Indistinguishability of particles- Spin and Statistics	4	7
3.6	Ideas of Bose Einstein distribution law and its application to black body radiation, FermiDirac Statistics and its application to electron gas	4	7

References:

1. Thermal and Statistical Physics, R.B. Singh Part 1
2. Thermal and Statistical Physics, R.B. Singh Part 1
3. An introduction to thermodynamics by Y.V.C. Rao
4. An introduction to Thermal Physics by D.V. Schroeder
5. Heat and thermodynamics by Mark W Zemansky, Richard H Dittman & Amit K
6. Chattopadhyay.
7. Thermodynamics and Statistical physics Brij Lal, N.Subrahmanyam and P S Hemne
8. Berkeley Physics Course Volume 5; Statistical Physics; Frederick Reif.
9. Statistical Mechanics, R.K. Pathria

8. Semester V
PH5B04U: Digital Electronics

SL.NO	COURSE OUTCOME	CONGNITIVE LEVEL	PSO
1	Understand the different number systems and its conversions.	Understand	1
2	Understand the basics of Boolean algebra and logic gates and study the methods to simplify Boolean expressions	Understand	1
3	Apply K map method to simplify Boolean expressions	Apply	5
4	Differentiate combinational logic circuits and sequential logic circuits.	Understand	1,5

5	Apply these logics in simple circuits.	Apply	1,5
6	Understand the working of Counters	Understand	1

Course Description

Module	Course Description	Hrs	CO
1.0	**Number Systems**	**8**	**1**
1.	Digital and analog systems- Comparison	1	1
1.2	Different number systems- decimal, binary, octal and hexadecimal	1	1
1.3	conversion between different systems	2	1
1.4	Binary arithmetic-addition, subtraction and multiplication.	2	1
1.5	Subtraction with 2's complement and 1's complement- BCD code, ASCII code	2	1
2.0	**Boolean Algebra**	**20**	**2,3**
2.1	Binary logic- AND,OR and NOT operators	2	2
2.2	Logic symbol and truth table	2	2
2.3	Laws of Boolean algebra- Demorgan's theorem	3	2
2.4	Duality theorem- Boolean functions- Complement of a function	2	2
2.5	Reducing Boolean expressions- Canonical and standard form	3	2
2.6	Conversion between truth table, Boolean expressions and Logic diagrams	2	2
2.7	Simplification of Boolean functions using Karnauh map(Two, three and four variables) NAND, NOR, XOR, XNOR gates	4	3
2.8	IC digital logic families (Familiarization only)	2	2
3.0	**Combinational ans Sequential Logic**	**26**	**4,5,6**
3.1	Adders- Half and Full adders- Subtractor- Four bit adder- Subtractor.	3	4,5
3.2	Encoders, Decoders, Multiplexers and Demultiplexers	4	4,5
3.3	Flip-flops, RS, Clocked RS, MSJK FF, DFF JK, T Flip-flop	4	5
3.4	Buffer registers- Shift register	5	5
3.5	Counters- Binary ripple counter- BCD ripple counter- synchronous binary counter- Decade counter.	6	6
3.6	D/A converters (Ladder type), A/D Converter (Counter type).	4	5

References:

1. Digital fundamentals, Thomas L. Floyed
2. Digital principles and applications, Malvino, Leach and Saha
3. Digital electronics, S Salivahanan & S Arivazhagan

4. Digital design, M Morris Mano
5. Object oriented programming in Turbo C++ - Robert Lafore
6. Digital logic and computer design - M Morris Mano, PHI

9. Semester V (Open Course)
PH5D01.2U : Energy and Environmental studies

Sl. No.	Course Outcome	Cognitive Level	PSO
1	Understand the different forms of energy in the universe and renewable sources	Understand	1
2	Understand the basics of Solar energy utilisation and its uses	Understand	1
3	Understand the sources of Environmental pollution and its effects	Understand	1
4	Undersatnd the basics of environmentimpact assesment and control	Understand	1
5	Understand different waste management techniques	Understand	1

Course Description

Module	Course Description	Hrs	CO
1.0	**Energy sources**	**14**	**1**
1.1	World's reserve of energy sources - various forms of energy	2	1
1.2	non- renewable energy sources:- coal, oil, natural gas; merits and demerits	3	1
1.3	renewable energy sources solar energy, biomass energy, biogas energy, wind energy, wave energy, tidal energy	3	1
1.4	hydro energy, geothermal, fusion energy, hydrogen; merits and demerits	3	1
1.5	storage of intermittently generated renewable energy (qualitative).	3	1
2.0	**Solar energy utilisation**	**14**	**2**
2.1	Sun as a source of energy - solar radiation - spectral distribution.	1	2
2.2	flat plate collector- solar water heating – different types of solar water heaters.	3	2
2.3	solar pond - convective and salt gradient types - optical	3	2

	concentrator - solar desalination.		
2.4	solar dryer – direct and indirect type - solar cooker - direct and indirect type.	3	2
2.5	solar heating of buildings - solar green houses.	2	2
2.6	solar photovoltaics - working principle.	2	2
3.0	**Environment Pullotion**	**20**	**3**
3.1	Basic concepts of ecology and environment	2	3
3.2	environmental pollution:- primary and secondary pollutants	3	3
3.3	classification - environmental degradation causes, effects and control/treatment methods	4	3
3.4	air pollution:- green house gases, global warming, climatic effects	4	3
3.5	water pollution, soil pollution, groundwater pollution	2	3
3.6	marine pollution, noise pollution, nuclear hazards	3	3
3.7	environmental pollution due to environmental disasters.	2	3
4.0	**Environment impact Assesment and control**	**8**	**4**
4.1	Basic ideas of environment impact assessment	2	4
4.2	environment ethics	2	4
4.3	environmental laws and constitutional provisions to control pollutions in India:- the general acts	2	4
4.4	water and air acts , environment protection acts.	2	4
5.0	**Waste management**	**14**	**5**
5.1	Waste minimization and resource conservation	1	5
5.2	Hazardous solid waste, municipal solid wastes, biomedical solid wastes	3	5
5.3	Waste treatment and disposal methods:- physical, biological and chemical process	3	5
5.4	Biogas plant-moving dome type.	2	5
5.5	Source reduction, recycling , conservation and waste minimization	3	5
5.6	Management of solid wastes (management and handling)	2	5

References

1.Essential Environmental Studies S.P Misra, S.N Pandey (Ane Books Pvt Ltd)
2.Environmental Science G Tyler Miller (Cengage Learning)
3. Introduction to Environmental Science Y Anjaneyulu (B S Publications)
4. Introduction to Environmental engineering and science- G.M. Masters and W.P. Ela(PHI Pvt. Ltd)

5. Environmental management- B. Krishnamoorthy (PHI Pvt. Ltd)
6. Solar energy- fundamentals and applications- H.P. Garg and J. Prakash (Tata Mc Graw Hill).
7. Solar energy-fundamentals, design, modeling and applications- G.N. Tiwari (Narosa Pub. House).

10. Semester VI
PH6B01U: Computational Physics

SL.NO	COURSE OUTCOME	CONGNITIVE LEVEL	PSO
1	Understand the working of Microprocessor 8085	Understand	1
2	Carry out operations using 8085	Apply	5
3	Understand the basics in computer hardwares	Understand	5
4	Understand the basics of programming using C++	Understand	1,5
5	Apply C++ logics in simple Programming	Apply	1,5
6	Understand the numerical methods and apply it for solving eqution s	Understand Apply	1,5

Course Description

Module	Course Description	Hrs	CO
1.0	**Microprocessors**	**20**	**1,2**
1.	Introduction to microprocessors- microprocessor operations (with relevance to 8085 microprocessor)	4	1
1.2	8085 bus organization-address bus- data bus- control bus, internal data operations- 8085 registers	5	1
1.3	Accumulator- flags- program counter- stack pointer, externally initiated operations	2	1
1.4	8085 microprocessor architecture- pinout and signals- internal architecture of 8085 microprocessor Machine language- assembly language- high level language.	4	1,2
1.5	Instruction cycle, machine cycle and T state- instruction format- addressing modes.The 8085 instruction set- simple programmes for data transfer, addition and subtraction	5	1,2
2.0	**Computer Hardware and Programming in C++**	**22**	**3,4,5**
2.1	Characteristics of a computer- I/O devices	2	3

2.2	Memory and storage devices- RAM, ROM,	2	3
2.3	Primary and secondary memory	1	3
2.4	Introduction- C ++ programming basics-	5	4
2.5	Loops and decisions- basic ideas of structures,	6	5
2.6	Arrays, functions, objects and classes	6	5
3.0	**Numerical methods**	**12**	**5, 6**
3.1	Iteration principle- solution of algebraic and transcendental equations	3	6
3.2	Bisection, false position and Newton-Raphson methods- algorithms	3	6
3.3	Numerical integration-trapezoidal rule and Simpson's 1/3 rule - algorithm	2	6
3.4	Numerical solution ofdifferential equation- Euler's method and second order Runge-Kutta method- algorithm.	2	6
3.5	Computer oriented numerical methods using C++	2	5

References

1.Microprocessor architecture, programming and applications- Ramesh S. Gaonkar (Penram Int. Pub.)
2. Fundamentals of Microprocessors and microcomputers- B. Ram (Dhanpat Rai Pub.)
3. Microcomputers and Microprocessors- John Uffenbeck (PHI Pub.)
4. Object oriented programming in Turbo C ++ - Robert Lafore (Galgotia Pub.)
5. Programming with C ++ - John R. Hubbard (Mc Graw Hill Pub.)
6. Numerical method- V. Rajaram (PHI Pub.)
7. Introductory methods of Numerical methods -S.S .Sastry (PHI Pub.)
8. Numerical method with computer programming in C ++ - Ghosh (PHI Pub.)

11. Semester VI
PH6B02U : Nuclear and Particle Physics

Sl. No	Course Outcome	Cognitive Level	PSO
1	Understand the structure and properties of nucleus.	Understand	1, 5
2	Understand different nuclear models.	Understand	1
3	Understand different particle accelerators and counters.	Understand	1
4.	Estimate the energy of nuclear reactions and understand thery of radioactivity	Apply understand	1, 5
5	Differentiate between different nuclear radiations.	Understand	1
6	Classify different types of Nuclear reactions and reactors	Understand	1
7	Categorize different elementary particles and Understand particle quantum numbers	Understand	1

8	Understand the effects of cosmic rays.	Understand	1

Course Description

Module	Course Description	Hrs	CO
1.0	**Nuclear structure and general properties of nuclei**	**15**	**1, 2, 3**
1.1	Classification of nuclei – Isotopes, Isobars, Isomers, Mirror nuclei.	1	1
1.2	General properties of nucleus – size, nuclear mass, density, charge, angular momentum, nuclear magnetic dipole moments, electric quadrupole moment,	2	1
1.3	Mass defect, B.E, B.E. curve, packing fraction, nuclear stability.	2	1
1.4	Theories of nuclear composition – proton-electron hypothesis – proton-neutron hypothesis.	3	2
1.5	Properties of Nuclearforces – Meson theory of nuclear forces.	1	2
1.6	Nuclear shell model.	2	2
1.7	Determination of nuclear mass by Bainbridge's mass spectrograph.	3	3
1.8	Detectors of nuclear radiations –ionisation chamber - G.M Counter.	1	3
2.0	**Radioactivity**	**18**	**4, 5**
2.1	Natural radioactivity – Radioactive disintegration law – half life – Mean life Radioactive series.	4	4
2.2	Radioactive dating – Uranium dating & Carbon dating Range of $\propto$ particles – range – energy relationship.	3	4
2.3	Geiger – Nuttal law Alpha particle disintegration energy Theory of $\propto$ - delay – Gamow's theory β- decay - β ray energy spectrum	3	4,5
2.4	Neutrino hypothesis Positron emission, orbital electron capture (Basic ideas only)	3	5
2.5	γ decay – Internal conversion Electron positron pair production by γ rays.	3	5
2.6	Electron positron annihilation. Artificial radioactivity & Transuranic elements. (Basic ideas only)	2	5
3.0	**Nuclear fission and fusion**	**11**	6
3.1	Discovery of nuclear fission – Fission products. Neutron emission in fission. Energy release in fission.	2	6
3.2	Nuclear fission on the basis of liquid drop model chain reaction	2	6
3.3	Nuclear reactor – Breeder reactor	2	6
3.4	Nuclear fusion Energy production in stars – Proton-Proton cycle and Carbon - Nitrogen cycle	2	6

3.5	Peaceful utilization fusion power Controlled thermo nuclear reactions Toroidal confinement	2	6
3.6	Nuclear waste disposal and radiation hazards from nuclear explosion – radiation dosage.	1	6
4.0	**Elementary particles**	**10**	**7,8**
4.1	Particles and antiparticles – Fundamental interactions in nature.	2	7
4.2	Classification of elementary particles according to nuclear interactions.	2	7
4.3	Resonance particles Elementary particle quantum numbers and conservation laws.	2	7
4.4	The quark model –compositions of hadron according to quark model.	2	7
4.5	Cosmic rays – Primary and secondary- lattitude effect- altitude effect- eastwest effect	2	8

References:

1. Concepts of Modern Physics- Arthur Beiser
2. Modern Physics- R Murugeshan and K. Sivaprasath
3. Atomic and Nuclear Physics- S N Ghoshal
4. Nuclear and Particle Physics- S L Kakani and Subhra Kakani

12. Semester VI

PH6B03U – Condensed Matter Physics

Sl.No.	Course Outcome	Cognitive Level	PSO
1	Recall the basic solid state structures already studied	Remember	1
2	Understand the basics of Solid State Physics.	Understand	1
3	Illustrate the different crystal types and bonding in solids found in nature.	Understand	1
4	Determine the free electron theory and elementary band theory	Apply	2
5	Understand the basics of material science	Understand	1
6	Understand the basics of superconductivity	Understand	1

Course Description

Module	Course Description	Hrs	CO
1.0	**Crystal Structure and Bonding**	**12**	**1,2,3**
1.1	Crystal Structure - Crystalline Matter - Bravias Lattice - Crystal Systems – Crystal Planes - and Miller Indices	2	1
1.2	Lattice Constants - Reciprocal Lattice – Crystal Structures - sc, bcc, fcc and hcp	3	2

1.3	Bragg's Law - Experimental Methods of X-Ray diffraction - Powder method.	2	2
1.4	Bonding in Solids - Ionic, Covalent, Van der Waal and Metallic Bonding (qualitative)	3	3
1.5	Binding Energy in Crystals - Madelung Constant.	2	3
2.0	**Free electron theory and Band Theory in Solids**	**15**	**4**
2.1	Free Electron theory in one dimension- Formation of Energy Bands-Bloch Theorem (Statement)	3	4
2.2	Kronig Penney Model –Brillouin Zones (qualitative) –Effective Mass	3	4
2.3	Carriers in Solids- Metals, Insulators and Semiconductors	3	4
2.4	Band Structure-Intrinsic and Extrinsic Semiconductors	3	4
2.5	Electric Conductivity Temperature Dependence- Hall effect.	3	4
3.0	**Superconductivity**	**10**	**6**
3.1	Zero resistance - Superconducting Phenomenon - Critical Temperature	3	6
3.2	Meissner Effect-Type I& II Superconductors - BCS theory (qualitative) - London Equation	4	6
3.3	Josephson Effect – SQUID - High Tc superconductors and applications.	3	6
4.0	**Material science and technology**	**7**	**5**
4.1	Amorphous Semiconductors	2	5
4.2	Liquid Crystals – Polymers	1	5
4.3	Thin films - Properties	1	5
4.4	Crystalline Materials and Applications	1	5
4.5	Nanostructures and Nanometerials-Applications.	2	5
5.0	**Elementary solid state Physics**	**5**	**5**
5.1	Thin film fundamentals	1	5
5.2	Nanostructures And Nanomaterials	2	5
5.3	Synthesis, Properties, And Applications,	2	5

References:

1. Kittel, C. Introduction to Solid State Physics, 8th edition (Wiley)
2. Ashcroft, N.W. & Mermin, N.D. Solid State Physics, TMH
3. Blakemore, J.S. Solid State Physics, 2nd edition (Cambridge)

4 C.L. Arora, Solid State Physics. S Chand.

5. S.O.Pillai, Solid State Physics. New Age International Pub.
6. Superconductivity, Superfluids and Condensate James F Annett Oxford

13. Semester VI

PH6B04U : Relativity and Spectroscopy

Sl.No	Course Outcome	Cognitive Level	PSO
1	Understand the concepts of special theory of relativity and to solve problems using it	Understand , Apply	1, 5
2	Explain different atom models	Uderstand	1
3	Illustrate Sodium D lines, Zeeman effect and Paschen-back effect on the basis of atomic spectroscopy	Understand	1
4	Understand electronic, vibrational and rotational energy levels of molecules.	Understand	1
5	Explain Raman effect based on classical and quantum theory	Understand	1
6	Basic principles and instrumentation of NMR and ESR spectroscopy	Understand	1

Course Description

Module	Course Description	Hrs	CO
1.0	**Special Theory of Relativity**	**18**	**1**
1.1	Inertial and non inertial frames of reference- Galilean transformation	2	1
1.2	Significance of Michelson-Morley experiment	2	1
1.3	Postulates of Special Theory of Relativity, Lorentz transformation	4	1
1.4	Spatial contraction, Time dilation, composition of velocities, mass of moving particle	5	1
1.5	Equivalence of mass and energy.	1	1
1.6	Introductory concept of general theory of relativity.	2	1
2.0	**Atomic Spectroscopy**	**21**	**2,3,7**
2.1	Historical introduction. Electromagnetic spectrum	2	2
2.2	Types of spectra. Absorption and emission of light by atoms, quantum theory	2	2
2.3	Early atom models – Bohr model, electron spin and magnetic moment, Exclusion principle	3	2
2.4	Stern-Gerlach experiment	2	2
2.5	Vector atom model, quantum numbers associated with vector atom models	3	2
2.6	Total angular momentum and LS coupling	2	2
2.7	Fine structure of Sodium D lines	2	3
2.8	Zeeman effect, quantum mechanical explanation for anomalous Zeeman effect	4	3,7

2.9	Paschen-Back effect.	1	3
3.0	**Molecular Spectroscopy, NMR and ESR Spectroscopy**	**33**	**4,5,6,7**
3.1	Molecular energy levels. Electronic, rotational and vibrational energies	2	4
3.2	Rotationalspectra, explanation in terms of rigid rotator model	3	4
3.3	Vibrational energy levels, explanation in terms of harmonic oscillator.	4	4
3.4	Electronic energy levels of atoms, Fluorescence and phosphorescence	4	4
3.5	Raman effect –experimental arrangement and result, classical theory and its failure, quantum theory ofRaman effect	5	5,7
3.6	IR and Microwave spectroscopes.	3	4
3.7	NMR Spectroscopy- Basic principles and instrumentation	4	6
3.8	Medical applications of NMR.	3	6
3.9	ESR Spectroscopy- Basic principles and instrumentation	5	6

References:

1. Molecular structure and spectroscopy, Aruldas
2. Modern Physics, Kenneth S Krane
3. Concepts of modern Physics, Arthur Beiser
4. Spectroscopy: Straughan and Walker –(Vol.1) John Wiley
5. Fundamentals of Molecular Spectroscopy: CN Banwell
6. Introduction to Atomic Spectra, HE White
7. Elements of spectroscopy, Guptha, Kumar and Sharma
8. Special Relativity- Resnick
9. Mechanics – D.S.Mathur
10. Mechanics - J.C. Upadhayaya (Ramprasad)
11. Semiconductor physics and optoelectronics- V Rajendran, J Hemaletha and M S M Gibson

14. Semester VI
PH5B05.2U: Information Technology

Sl No.	Course Outcome	Cognitive Level	PSO
1	Understand the need and scope of information technology and its tools	Understand	1
2	Understand the various types of computer networks ,networking models and network topology	Understand	1

3	Understand the basics of internet based communication techniques , its security and uses	Understand	1
4	Understand the basics of HTML and create simple programs using HTML	Understand Apply	1,5
5	Understand the basic idea of DBMS and its scope and usage	Understand	1
6	Familiarise the usage of MS office and Spreadsheet databases	Understand Apply	1,5

Course description

Module	Course description	Hrs	CO
1.0	**Information and its use, Computer networks and the internet**	**32**	**1,2,3**
1.1	Information Technology – Quality of information – Message transmission – Electronic Office	3	1
1.2	E mail – Document storage – Computers in Industry –Different types – Graphical user interface	3	1
1.3	Importance of Networks. Components of Networks. Classification of Networks: Broad cast networks-Switched networks. Switching Techniques.	4	2
1.4	Types of Networks – LAN – MAN – WAN. Networking Models – OSI reference model – TCP/IP reference model-Comparison between the OSI and TCP/IP models.	5	2
1.5	Network Topology – Bus- Star-Ring-Tree-Mesh-Cellular. Network Architecture – Client/Server, Peer-to-Peer	3	2
1.6	Internet Protocols – Internet Protocol (IP)-Transmission Control Protocol (TCP) -Internet Address	3	3
1.7	Structure of Internet Servers Address-Address Space-Internet Infrastructure -Services on Internet – Domain Name System-SMTP and Electronic mail	4	3
1.8	Http and World Wide Web-Usenet and News groups-FTP-Telnet-Network Security – Ideas of secret key Algorithms and Public key Algorithms	4	3
1.9	Digital Signature-E-mail Privacy-Internet tools – Search Engines-Web browsers- Internet explorer, Netscape Navigator, Mozilla Firefox(Working Knowledge)	3	3

2.0	**The HTML**	**32**	**4**
2.1	What is HTML? Basic Tags of HTML – HTML-TITLE-BODY - Starting an HTML document – The <!DOCTYPE>declaration	3	4
2.2	setting boundaries with <HTML>-the HEAD element-the BODY element-the STYLE element and the SCRIPT element	4	4
2.3	Formatting of text – Headers-Formatting Tags-PRE tag-FONT tag-Special Characters. Working with Images- META tag	4	4
2.4	Links – Anchor Tag -Lists – Unordered Lists-Ordered Lists-Definition Lists -Tables –TABLE, TR and TD Tags-Cell Spacing and Cell Padding	5	4
2.5	Colspan and Rowspan -Frames – Frameset-FRAME Tag-NOFRAMES Tag - Forms – FORM and INPUT Tag-Text Box	6	4
2.6	Radio Button-Checkbox-SELECT Tag and Pull Down Lists-Hidden-Submit and Reset -Some Special Tags	5	4
2.8	COLGROUP-THREAD,TBODY-TFOOT-_blank-_self,_parent-_top-IRFRAME-LABEL-Attribute for <SELECT>-TEXTAREA	5	4
3.0	**Basic ideas of DBMS , MS office and spreadsheet database**	**26**	**5,6**
3.1	Need for Data Base – Database Systems versus File systems - View ofData	4	5
3.2	Data Abstraction-Instances and Schemas - Data Models – ER Model-Relational Model	3	5
3.3	Network Model-Hierarchical Model (general ideas) -Basic ideas about Structured Query Language	3	5
3.4	MS – OFFICE/OPEN OFFICE (Working Knowledge): Word processors – PowerPoint	6	6
3.5	MS office (97, 98, 2000, /Open Office which is installed in the lab can be used.	4	6
3.6	Working practise	6	6

Reference

1. Information Technology – The Breaking Wave, D.Curtin, K.Sen and K.Morin,Tata McGraw Hill, 1999.
2. Computer Networks – A.S. Tanenbaum - Prentice Hall of India
3. Computer Fundamentals – P.K. Sinha 3rd Edn. BPB Publications
4. Internet and World Wide Web – Deitel
5. HTML4 – 2nd Edn. Rick Darnell, Techmedia

15. Semester I (Core Practical)

PH1B01 U

Sl.No.	Course Outcome	Cognitive Level	PSO
1.	Understand different length measurement devices and their working.	Understand, Apply	2,3,4,6
2.	Determine mass of solid using Beam balance	Understand, Apply	2,3,4,6
3.	Determine radius of capillary tube using travelling microscope	Understand, Apply	2,3,4,6
4.	Determine electrical properties using multimeter and identification of electronic components	Understand, Apply	2,3,4,6
5.	Determine viscosity of liquid and angle of prism	Understand, Apply	2,3,4,6

Course Description

Sl.No	Course Description	Hrs	CO
1	Vernier Calipers - Volume of a cylinder, sphere and a hollow cylinder	2	1
2	Screw gauge - Volume of a sphere and a glass plate	2	1
3	Spherometer - Thickness of a glass plate, radius of curvature of a convex surface and a concave surface	2	1
4	Beam balance - Mass of a solid (sensibility method), radius measurement of capillary tube using mercury	2	2
5	Travelling microscope - Radius of a capillary tube	2	3
6	Multimeter -Measurement of resistance, potential difference, current	2	4
7	Multimeter -Checking of capacitor ,diode ,inductance and transistor	2	4
8	Identification of electronic components- Coil, capacitor, resistor, transistor, triac, diac, I C's 741,555 etc.	2	4
9	Viscosity of a liquid-Variable pressure head	2	5
10	Spectrometer- Angle of prism		5

16. Semester II (Core Practical)

PH2B01U

Sl.No.	Course Outcome	Cognitive Level	PSO
1.	Determination of Young's modulus and acceleration due to gravity	Understand, Apply	2,3,4,6
2.	Calculation of resistivity of wire and load and line regulations	Understand, Apply	2,3,4,6
3.	Determine Surface tension and viscosity of liquids	Understand, Apply	2,3,4,6
4.	Convert a galvanometer into voltmeter or to find the magnetic field along a circular coil	Understand, Apply	2,3,4,6
5.	Calculate refractive index and electrochemical equivalent of copper	Understand, Apply	2,3,4,6

Sl.No	Course Description	Hrs	CO
1	Cantilever- pin & microscope –Determination of Young's modulus	2	1
2	Carey Foster's Bridge-Measurement of resistivity	2	2
3	Symmetric Compound Pendulum-Determination of radius of gyration(K) and Acceleration due to gravity (g)	2	1
4	Surface tension - Capillary rise method	2	3
5	Half wave rectifier with and without filter-ripple factor and load regulation	2	2
6	Conversion of Galvanometer into voltmeter	2	4
7	Viscosity-constant pressure head- coefficient of viscosity (η) of the liquid	2	3
8	Spectrometer- Refractive Index of material of Prism	2	5
9	Field along the axis of a coil-Variation of magnetic field along the axis of a circular coil	2	4
10	Electro chemical equivalent of copper	2	5

17. Semester III (Core Practical)

PH3B01U

Sl.No	Course Outcome	Cognitive Level	PSO
1	Determine optical constants of different materials using spectrometer	Apply	1, 2,3,4,5,6
2	Execute and analyse the characteristics of semiconductor devices.	Apply, Analyze	1,2,3,4,5
3	Determination of the mechanical properties of different materials	Apply, Analyze	1,2,3,4,5
4	Determination of electrical properties	Apply, Analyze	1,2,3,4,5

Course Description

Sl.No	Course Description	Hrs	CO
1	Cantilever – Scale and Telescope-Determination of Young's modulus	2	3
2	Carey Foster's Bridge-Temperature coefficient	2	4
3	Asymmetric Compound Pendulum-Determination of K and g	2	3
4	Spectrometer-refractive index of a liquid –Hollow prism	2	1
5	Diode Characteristics.	2	2
6	Potentiometer-Measurement of resistivity	2	4
7	Full wave rectifier using diode – Ripple factor and load regulation	2	2
8	Transistor characteristics- CE configuration	2	2
9	Gates AND,OR,NOT- Verification of Truth Table	2	2
10	Torsion pendulum - Rigidity modulus	2	3

18. Semester IV (Core Practical)

PH4B01U

Sl.No	Course Outcome	Cognitive Level	PSO
1	Determine optical constants of different materials using spectrometer	Apply	1, 2,3,4,5,6
2	Execute and analyse the characteristics of semiconductor devices.	Apply, Analyze	1,2,3,4,5
3	Determination of the mechanical and thermal properties of different materials	Apply, Analyze	1,2,3,4,5
4	Determination of electrical and magnetic properties	Apply, Analyze	1,2,3,4,5

Course Description

Sl.No	Course Description	Hrs	CO
1	Non-uniform bending- Pin and Microscope method	2	3
2	Thermal conductivity of bad conductor- Lee's Disc	2	3
3	Bridge rectifier with filter and without filter- Ripple factor and load regulation	2	2
4	Spectrometer-prism- i-d curve	2	1
5	Potentiometer-Calibration of low range voltmeter	2	4
6	Searle's Vibration Magnetometer-Magnetic moment	2	4
7	Transistor Characteristics - CB configuration	2	2
8	Diode clamper- Positive and negative	2	2
9	Study of UJT characteristics	2	2
10	Sweep generator using transistor	2	2

SEMESTER V

PH5B01U

Sl.No.	COs	Cognitive level	PSOs
1	Estimate the rigidity modulus, Youngs modulus and moment of inertia	Apply	
2	Determination of viscosity	Apply	
3	Concepts related to thermal physics		
4	Concept of wave motion	Analyze	
5	Determine optical constants using varying experimental methods	Apply	

Course Description

Expt	Course Description	Hrs	CO
1	Fly Wheel – Moment of Inertia	2	1
2	Uniform bending – Young's Modulus-Optic lever method	2	1
3	Static torsion- Rigidity modulus	2	1
4	Viscosity- Stoke's method	2	2
5	Viscosity- Searle's rotation viscometer method	2	2
6	Thermal conductivity of rubber	2	3
7	Melde's String – Measurement frequency	2	4
8	Sonometer – Verification of laws, Measurement of density of solid.	2	4
9	A.C Sonometer- Frequency of a.c.	2	4
10	Liquid Lens- Refractive index of Liquid	2	5

PH5B02U

Sl.No.	COs	Cognitive level	PSOs
1	Determine optical constants using varying experimental methods	Apply	
2	Estimation and calibration of basic electrical equipments.	Apply	
3	Illustrate basic current flow	Understand	
4	Determine the figure of merit	Apply	

Course Description

Expt	Course Description	Hrs	CO
1	Spectrometer – Grating- wave length	2	1
2	Spectrometer- prism-Dispersive power	2	1
3	Liquid lens-Optical constants of a convex lens	2	1
4	Air wedge-Diameter of wire	2	1
5	Potentiometer-Calibration of low range ammeter	2	2
6	Potentiometer-Calibration of high range voltmeter	2	2
7	Conversion of Galvanometer into ammeter	2	2
8	LCR circuit analysis-Series, parallel and Q-factor	2	3
9	Mirror Galvanometer-Figure of merit	2	4
10	B.G - charge sensitivity – Standard capacitor method	2	3

PH5B03U

Sl.No.	COs	Cognitive level	PSOs
1	Facts and conclusions of current circuit		
2	Verification of oscillatory circuits	Analyze	

Course Description

Expt	Course Description	Hrs	CO
1	Characteristics of Zener diode	2	1
2	Voltage regulation using Zener diode	2	1
3	Voltage multiplier- Doubler and Tripler	2	1
4	Characteristics of FET	2	1
5	Regulated power supply using IC 741	2	1
6	Wave shaping R C circuits - Integrator and differentiator	2	1
7	Diode clipper- Positive, Negative and Biased	2	1
8	Hartley Oscillator –frequency	2	2
9	Colpitt’s oscillator –frequency	2	2

10	Phase shift oscillator- frequency	2	2

PH5B04U

Sl.No.	COs	Cognitive level	PSOs
1	Determination of spectroscopic and optical parameters	Apply	
2	Concept of wave motion		
3	Verification of electronic theorems and circuits	Analyze	
4	Determine the magnetic field and related parameters	Apply	

Course Description

Expt	Course Description	Hrs	CO
1	Spectrometer – Grating- dispersive power	2	1
2	Spectrometer – Cauchy's constants	2	1
3	Newton's rings- Determination of wave length.	2	1
4	Laser- Determination of wave length	2	1
5	Ultrasonic- Determination of velocity of ultrasonic waves	2	2
6	Single slit – Diffraction using Laser	2	1
7	Verification of Thevenin's and Norton's theorem	2	3
8	Deflection and Vibration Magnetometer- m & Bh	2	4
9	e/m – Thomson's apparatus- Bar magnet/magnetic focusing	2	4
10	B.G - Measurement of capacitance	2	3

SEMESTER VI

PH6B01U

Sl.No.	COs	Cognitive level	PSOs
1	Calculation of Physical constants	Apply	
2	Determination of spectroscopic parameters	Apply	
3	Determine the magnetic field and related parameters	Apply	
4	Determination of sound wave velocity	Apply	
5	Verification of law of cooling	Analyze	
6	Carry out C++ programs	Apply	

Course Description

Expt	Course Description	Hrs	CO
1	Young's Modulus –Koenig's method	2	1
2	Torsion pendulum- n and I - using two identical masses	2	1
3	Spectrometer- Small angled prism-Refractive index of material of prism	2	2
4	Field along the axis of circular coil-Moment of magnet (null method)	2	3
5	Kater's pendulum-g	2	1
6	Kundt's tube- Velocity of sound	2	4
7	Sp.heat of liquid –Newton's law of cooling	2	5
8	Computer programming – Simple Pendulum –Calculation of 'g' from experimental data	2	6
9	Computer programming – Solving differential equation - Rungekutta method – II order.	2	6
10	Computer programming – Multiplication of any two matrices- (m x n) and (n x q)	2	6

PH6B02U

Sl.No.	COs	Cognitive level	PSOs
1	Verify the truth table of universal gates	Analyze	
2	Determination of high resistance	Apply	
3	Characteristic study of electronic circuits	Analyze	
4	Illustrate the working of microprocessor	Understand	
5	Carry out C++ programs	Apply	

Course Description

Expt	Course Description	Hrs	CO
1	Universal gates IC – NAND,NOR-Realize basic gates from universal gates	2	1
2	B.G. –Measurement of high resistance by leakage method	2	2
3	BCD to 7 segment decoder (IC)	2	3
4	Astable multivibrator – using transistor	2	3
5	Monostable multivibrator- using transistor	2	3
6	Monostable multivibrator – IC 555	2	3
7	8085 Microprocessor – sorting in ascending and descending order.	2	4
8	Computer programming –Conversion of temperature scale	2	5
9	Computer programming –sorting the numbers in ascending and	2	5

	descending order		
10	Computer programming – Solving a quadratic equation	2	5

PH6B03U

Sl.No.	COs	Cognitive level	PSOs
1	Facts and inferences on thermal parameters	Analyze	
2	Verification of electronic theorems and circuits	Analyze	
3	Illustrate the process of modulation	Understand	

Course Description

Expt	Course Description	Hrs	CO
1	Thermistor – Temperature coefficient of resistance	2	1
2	Regulated power supply – Transistor and Zener diode	2	2
3	Regulated power supply – Using IC's- LM 7805, 7905, 7809, 7909, 7812, 7912	2	2
4	Construction and measurement of a dual Regulated power supply with filter.	2	2
5	Op-Amp - Adder and Subtractor	2	2
6	R.C. Coupled amplifier - Gain	2	2
7	Amplitude modulation	2	3
8	Pulse width modulation	2	3
9	Ring counter using 74194 and 74151	2	2
10	Astable multivibrator – IC 555	2	2

PH6B04U

Sl.No.	COs	Cognitive level	PSOs
1	Characteristic study of electronic circuits	Analyze	
2	Illustrate the working of microprocessor	Understand	
3	Carry out C++ programs	Apply	

Course Description

Expt	Course Description	Hrs	CO
1	D/A Converter using IC	2	1
2	4 bit Shift register	2	1
3	Flip-Flop – R.S	2	1
4	J.K Flip-Flop	2	1

5	Schmitt trigger using 7414	2	1
6	Op- Amp – Inverter, non inverter and buffer.	2	1
7	8085 Microprocessor - BCD addition and subtraction	2	2
8	8085 Microprocessor – multiplication of two eight bit numbers with result 16 bit	2	2
9	Computer programming – Solving a linear equation- Bisection method.	2	3
10	Computer programming – Solving a equation by Newton – Raphson method	2	3
11	Computer programming- Generation of Fibonacci series	2	3

Course Outcome for Complementary Physics

1. Semester I (complementary physics for Mathematics)

MT1C01U: Properties of Matter, Mechanics and Fourier analysis

Sl.No	Course Outcome	Cognitive Level	PSO
1	Understand the elastic behavior of materials	Understand	1
2	Understand the rotational dynamics of rigid bodies	Apply	2
3	Calculate the moment of inertia of different bodies	Understand Apply	5
4	Understand oscillatory motion	Understand	5
5	Understand the basics of Fourier analysis	Understand	1

Course Description

Sl. No.	Course description	Hrs.	CO
1.0	**Elasticity**	**12**	**1**
1.1	Stress- strain- Hooke's law- Elastic moduli- Poisson's ratio- twisting couple	2	1
1.2	Determination of rigidity modulus- static and dynamic methods-	1	1
	static torsion- torsion pendulum		1

1.3	Bending of beams- Cantilever, uniform and non-uniform bending	4	1
1.4	I - section girder	1	1
2.0	**Rotational dynamics of rigid bodies**	**10**	**2,3**
2.1	Angular velocity- angular momentum- torque	2	2
2.2	conservation of angular momentum- angular acceleration-	1	2
2.3	moment of inertia- parallel and perpendicular axes theorems	2	2
2.4	moment of inertia of rod, ring, disc, cylinder and sphere	2	3
2.5	flywheel	2	3
3.0	**Oscillations**	**9**	**4**
3.1	Periodic and oscillatory motion	1	4
3.2	simple harmonic motion- differential equation	2	4
3.3	expression for displacement, velocity and acceleration- graphical representation	3	4
3.4	energy of a particle executing simple harmonic motion	3	4
3.5	damped oscillation- forced oscillation and resonance	4	
4.0	**Fourier Analysis**	**9**	**5**
4.1	Fourier's theorem- evaluation of Fourier coefficients	4	5
4.2	analysis of square wave, saw tooth wave and triangular wave	5	5

Reference:

1. Mechanics- H.S.Hans and S.P.Puri.
(Tata McGraw-Hill)
2. Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)
3. Mechanics- J.C. Upadhyaya (Ram Prasad and sons)
4. Mathematical methods for Physicists – G. B. Arfken and H.J. Weber
(Academic press

2. Semester II (complementary physics for Mathematics) MT2C01U: Electric and Magnetic phenomena, Thermodynamics and Special theory of Relativity

Sl.No	Course Outcome	Cognitive Level	PSO
1	Understand the dielectric properties of materials	Understand	1
2	Understand magnetism and magnetic hysterisis	Understand	1
3	Understand Thermodynamics concepts	Remember, Understand	1,5
4	Derive Maxwells thermodyna realations	Understand	1
5	Understand special theory of relativity	Understand	1

Course Description

Sl. No.	Course description	Hrs.	CO
1.0	**Dielectric materials**	**7**	**1**
1.1	Dielectrics- polar and non-polar dielectrics	2	1
1.2	polarization- sources of polarization	1	1
1.3	Gauss's law in dielectrics- permittivity- dielectric displacement vector	2	1
1.4	dielectric constant-susceptibility- ferroelectricity	2	1
2.0	**Magnet Materials**	**7**	**2**
2.1	Magnetization in materials- linear and non-linear materials	2	2
2.2	diamagnetism- paramagnetism	1	2
2.3	Ferromagnetism-hysteresis-ferromagnetic domains	2	2
2.4	antiferromagnetism- ferrimagnetism	2	2
3.0	**Thermodynamics**	**12**	**3,4**
3.1	Thermodynamic systems-thermodynamic equilibrium- thermodynamic processes- isothermal process- adiabatic process	3	3
3.2	zeroth law of thermodynamics- first law of thermodynamics- heat engine- the Carnot engine- refrigerator	3	3
3.3	concept of entropy- second law of thermodynamics- third law ofthermodynamics-	4	3
3.4	Maxwell's thermodynamic relations	2	4
4.0	**Special theory of relativity**	**10**	**5**
4.1	Introduction- Galilean transformation- Newtonian principle of relativity- special theory- postulates	4	5
4.2	Lorentz transformation- length contraction- time	3	5

	dilation- relativity of simultaneity		
4.3	addition of velocities- relativistic mass transformation- mass energy relation	3	5

Reference:

1. Introduction to Modern Physics- H.S. Mani and G.K. Mehta
2. Concepts of Modern Physics- A. Beiser
3. Modern Physics- R. Murugeshan
(Tata McGraw-Hill, 5th Edn.)
(S. Chand and Co.)
4. Introduction of Electrodynamics- D.J. Griffiths (PHI Pvt. Ltd)
5. Modern Physics- G.Aruldas and P.Rajagopal (PHI Pub)
6. Thermodynamics- Zemansky and Dittmann (Tata McGraw-Hill)

3. Semester III (Complementary Physics for Mathematics) MT3C01U: Quantum Mechanics, Spectroscopy, Nuclear Physics, Basic Electronics and Digital Electronics

Sl No.	Course Outcome	Cognitive Level	PSO
1	Understand and list the basic features of Bohr atom model, and the different coupling schemes.	Understand	1
2	Understand the basic properties of atomic nucleus and nuclear forces.	Understand	1
3	Understand the features of radioactivity and to compute the disintegration of radioactivity.	Understand, Apply	2,5
4	Explain the failures of classical mechanics and the emergence of quantum mechanics by illustrating black body spectrum, photo electric efect and Compton effect.	Understand	1
5	Understand the Schrodinger equations and to solve the problems related to it.	Understand, Apply	1,5
6	Explain different modes of molecular excitations.	Understand	1
7	Understand the basics of diodes and its applications.	Understand	1
8	Explain different number systems and to find the output of different logic gates and solve complex circuits using logic gates.	Understand Apply	1,5

Course Description

Module	Course Description	Hrs	CO
1.0	**Modern Physics**	**18**	**1,2,3**
1.1	Basic features of Bohr atom model-formula for energy	1	1
1.2	Vector atom model- various quantum numbers	2	1
1.3	Coupling schemes-LS and JJ coupling	1	1
1.4	Pauli's exclusion principle-magnetic moment of orbital electrons	2	1
1.5	Atomic nucleus classification-basic properties of nucleus-charge, mass, spin, magnetic moment binding energy and packing fraction	4	2
1.6	Nuclear forces-salient features	1	2
1.7	Radioactivity- properties of alpha, beta and gamma- Soddy Fajan's displacement law	2	3
1.8	Law of radioactive disintegration -decay constant	1	3
1.9	Half life and mean life	2	3
1.10	radioactive equilibrium - measurement of radioactivity Radio carbon dating	2	3
2.0	**Quantum Mechanics ,Spectroscopy**	**18**	**4,5,6**
2.1	Inadequacies of classical physics-experimental evidences	4	4
2.2	Evidences for quantum theory-Planck's hypothesis	1	4
2.3	Foundation of quantum mechanics-wave function & probability density	3	4
2.4	Schrödinger equation-time dependent and time independent	3	5
2.5	Particle in a potential box.	1	5
2.6	Optical spectra- spectral terms, selection rules	1	6
2.7	hyperfine structure; molecular spectra-rotational, vibrational and electronic spectra	2	6
2.8	Raman effect- experimental study, quantum theory	1	6
2.9	fluorescence and phosphorescence; comparison of Raman, fluorescence and IR spectra; NMR	1	6
3.0	**Electronics**	**8**	**7**
3.1	Current-voltage characteristics of a diode-forward and reverse bias	1	7
3.2	Breakdown mechanism of p-n junction diode	1	7

3.3	Zener diode and its characteristics	1	7
3.4	Half wave and full wave rectifiers- bridge rectifier-ripple factor, efficiency	3	7
3.5	Construction and operation of a bipolar junction transistor	2	7
4.0	**Digital Electronics**	**10**	**8**
4.1	Different number systems – decimal, binary, octal, hexa decimal number systems	1	8
4.2	Conversion between different number systems	2	8
4.3	Binary mathematics – addition, subtraction (1's compliment and 2's compliment methods)	3	8
4.5	Basic theorems of Boolean algebra- de Morgan's theorems	1	8
4.6	Simplification of Boolean equations - AND, OR, NOT, NAND, NOR, XOR gates- truth tables	2	8
4.6	Half adder- full adder	1	8

References

1. Modern Physics- R. Murugeshan, Er. Kirthiga Sivaprasad
2. Principles of electronics, V K Mehta,
3. Digital principles and applications- A. P. Malvino and P. Leach
4. Concepts of Modern Physics: Arthur Beiser
5. Basic Electronics , B L Thereja

4. Semester IV (Complementary Physics for Mathematics)
MT4C01U: Physical Optics, Laser Physics and Astrophysics

Sl. No.	Course Outcome	Cognitive Level	PSO
1	Understand the basic ideas of optics – Interference, Diffraction, Polarization.	Understand	1
2	Illustrate the principles of laser.	Understand	1
3	Understand the working principle of optic fibers and to classify it.	Understand	1
4	Explain the basic ideas of Astrophysics	Understand	1
5	Solve problems in optics	Understand	1

Course Description

Module	Course description	Hr	CO
1.0	**Interference, Diffraction and Polarization**	**22**	**1,5**
1.1	Introduction-Interference, light waves, phase difference, coherence, optical path and phase change.	1	1
1.2	Principle of superposition, young's double slit experiment, conditions for interference.	1	1
1.3	Conditions for sustained interference patterns, constuctive and destructive interference.	1	1
1.4	Thin film interference- reflected system, colour of thin films, fringes of equal inclination and equal thickness.	1	1
1.5	Newtons's rings – Reflected system – measurement of wavelength, Problems	2	1,6
1.6	Introduction – Diffraction – Fresnel and Fraunhoffer diffractions, Fresnels theory of rectilinear propagation of light, Problems	3	1,6
1.7	Fraunhoffer diffraction at single slit, width of central bright maxima.	1	1
1.8	Intensity in Fraunhoffer diffraction pattern. Problems	1	1,6
1.9	Introduction – Grating, construction and working of plane transmission grating	1	1
1.10	Determination of wavelength of light using grating.	1	1
1.11	Dispersive and resolving power of grating. Problems	2	1,6
1.12	Prism and grating spectra, rayleigh's criterion for resolution.	1	1
1.13	Introduction- Polarization, CPL, EPL and PPL	1	1
1.14	Brewster's law, Dichroism	1	1

1.15	Birefringence- E ray and O ray	1	1
1.16	Polarizer and analyser	1	1
1.17	Malu's law, optical activity	2	1
2.0	**Laser and Fiber Optics**	**10**	**2,3,5**
2.1	Introduction – Laser – Principle of operation of laser	1	2
2.2	Population inversion, metastable state, optical resonator	1	2
2.3	Components of laser – active medium, pump, optical resonant cavity	1	2
2.4	Principal pumping schemes	1	2
2.5	Three level and four level systems	1	2
2.5	Laser beam characteristics, applications of laser	1	2
2.6	Light propagation in optical fibres, Types of optical fibers- step index and graded index fibers	2	3
2.7	Acceptance angle, Numerical aperture, derivation and problems	3	3,6
3.0	**Astrophysics**	**9**	**4**
3.1	Temperature and color of a star- brightness- size of a star--- e- (all topics to be treated qualitatively)	2	4
3.2	Elements present in a stellar atmosphere- mass of star- life time of a star	2	4
3.3	Main sequence stars- HR diagram	2	4
3.4	Evolution of stars- white dwarf- supernova explosion- neutron star- black hole	3	4

References:

1. Optics - Brijlal and N. Subrahmanyam,
2. Electricity and Magnetism , D C Tayal
3. Electricity and Magnetism- J. H. Fewkes & John Yarwood
4. Electricity and Magnetism – R. Murugeshan
5. Nuclear physics –Irvin Kaplan
6. Lasers – theory & applications- Thyagarajan & Ghatak
7. Concepts of Modern Physics- A. Beiser
8. Laser Physics and Applications, V K Jain
9. Optical Fiber Communications, John M Senior

5. Semester I (Complementary physics for Chemistry)

CH1C01U: Properties of Matter, Mechanics and particle physics

Sl.No	Course Outcome	Cognitive Level	PSO
1	Understand the elastic behavior of materials	Understand	1
2	Understand the rotational dynamics of rigid bodies	Apply	2
3	Calculate the moment of inertia of different bodies	Understand Apply	5
4	Understand oscillatory motion	Understand	5
5	Understand the basics of particle physics	Understand	1

Course Description

Sl. No.	Course description	Hrs.	CO
1.0	**Elasticity**	**12**	**1**
1.1	Stress- strain- Hooke's law- Elastic moduli- Poisson's ratio- twisting couple	2	1
1.2	Determination of rigidity modulus- static and dynamic methods-	1	1
	static torsion- torsion pendulum		1
1.3	Bending of beams- Cantilever, uniform and non-uniform bending	4	1
1.4	I - section girder	1	1

2.0	**Rotational dynamics of rigid bodies**	**10**	**2,3**
2.1	Angular velocity- angular momentum- torque	2	2
2.2	conservation of angular momentum- angular acceleration-	1	2
2.3	moment of inertia- parallel and perpendicular axes theorems	2	2
2.4	moment of inertia of rod, ring, disc, cylinder and sphere	2	3
2.5	flywheel	2	3
3.0	**Oscillations**	**9**	**4**
3.1	Periodic and oscillatory motion	1	4
3.2	simple harmonic motion- differential equation	2	4
3.3	expression for displacement, velocity and acceleration- graphical representation	3	4
3.4	energy of a particle executing simple harmonic motion	3	4
3.5	damped oscillation- forced oscillation and resonance	4	
4.0	**Particle physics**	**5**	**5**
4.1	Fundamental interactions in nature- gauge particles- classification of particles-	2	5
4.2	antiparticles- elementary particle quantum numbers- conservation laws- quark model (qualitative)	3	5

Reference:

1. Mechanics- H.S.Hans and S.P.Puri.
(Tata McGraw-Hill)
2. Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)
3. Mechanics- J.C. Upadhyaya (Ram Prasad and sons)
4. Mathematical methods for Physicists – G. B. Arfken and H.J. Weber

12. Semester II (Complementary physics for Chemistry)

MT2C01U: Electric and Magnetic phenomena, Thermodynamics and Elementary Solid State Physics

Sl.No	Course Outcome	Cognitive Level	PSO
1	Understand the dielectric properties of materials	Understand	1
2	Understand magnetism and magnetic hysterisis	Understand	1

3	Understand Thermodynamics concepts	Remember, Understand	1,5
4	Derive Maxwells thermodyna realations	Understand	1
5	Understand basic solid state physics	Understand	1

Course Description

Sl. No.	Course description	Hrs.	CO
1.0	**Dielectric materials**	**7**	**1**
1.1	Dielectrics- polar and non-polar dielectrics	2	1
1.2	polarization- sources of polarization	1	1
1.3	Gauss's law in dielectrics- permittivity- dielectric displacement vector	2	1
1.4	dielectric constant-susceptibility- ferroelectricity	2	1
2.0	**Magnetic Materials**	**7**	**2**
2.1	Magnetization in materials- linear and non-linear materials	2	2
2.2	diamagnetism- paramagnetism	1	2
2.3	Ferromagnetism-hysteresis-ferromagnetic domains	2	2
2.4	antiferromagnetism- ferrimagnetism	2	2
3.0	**Thermodynamics**	**12**	**3,4**
3.1	Thermodynamic systems-thermodynamic equilibrium- thermodynamic processes- isothermal process- adiabatic process	3	3
3.2	zeroth law of thermodynamics- first law of thermodynamics- heat engine- the Carnot engine- refrigerator	3	3
3.3	concept of entropy- second law of thermodynamics- third law ofthermodynamics-	4	3
3.4	Maxwell's thermodynamic relations	2	4
4.0	**Crystalline solids**	**10**	**5**
4.1	Crystalline and amorphous solids- crystal lattice- basis- unit cell	4	5
4.2	lattice parameters- crystal systems- crystal planes and directions- miller indices	3	5
4.3	simple cubic- fcc -bcc hcp structures- packing fraction- NaCl structure- crystal diffraction- Bragg's law	3	5

Reference:

1. Introduction to Modern Physics- H.S. Mani and G.K. Mehta
2. Concepts of Modern Physics- A. Beiser
3. Modern Physics- R. Murugeshan

(Tata McGraw-Hill, 5th Edn.)
(S. Chand and Co.)
4. Introduction of Electrodynamics- D.J. Griffiths (PHI Pvt. Ltd)
5. Modern Physics- G.Aruldas and P.Rajagopal (PHI Pub)
6. Thermodynamics- Zemansky and Dittmann (Tata McGraw-Hill)

13. Semester III (Complementary Physics for Chemistry)

CH3C01U: Quantum mechanics, Spectroscopy, Nuclear Physics and Electronics

Sl No.	Course Outcome	Cognitive Level	PSO
1	Understand and list the basic features of Bohr atom model, and the different coupling schemes.	Understand	1
2	Understand the basic properties of atomic nucleus and nuclear forces.	Understand	1
3	Understand the features of radioactivity and to compute the disintegration of radioactivity	Understand, Apply	2,5
4	Explain the failures of classical mechanics and the emergence of quantum mechanics by illustrating black body spectrum, photo electric efect and Compton effect.	Understand	1
5	Understand the Schrodinger equations and to solve the problems related to it.	Understand,Apply	1,5
6	Explain different modes of molecular excitations.	Understand	1
7	Understand the basics of nuclear fission and fusion	Understand	1
8	Understand the basics of electronics	Understand	1

Course Description

Module	Course Description	Hrs	CO
1.0	**Modern Physics**	**18**	**1,2,3**
1.1	Basic features of Bohr atom model-formula for energy	1	1
1.2	Vector atom model- various quantum numbers	2	1

1.3	Coupling schemes-LS and JJ coupling	1	1
1.4	Pauli's exclusion principle-magnetic moment of orbital electrons	2	1
1.5	Atomic nucleus classification-basic properties of nucleus-charge, mass, spin, magnetic moment binding energy and packing fraction	4	2
1.6	Nuclear forces-salient features	1	2
1.7	Radioactivity- properties of alpha, beta and gamma- Soddy Fajan's displacement law	2	3
1.8	Law of radioactive disintegration -decay constant	1	3
1.9	Half life and mean life	2	3
1.10	radioactive equilibrium - measurement of radioactivity Radio carbon dating	2	3
2.0	**Quantum Mechanics ,Spectroscopy**	**18**	**4,5,6**
2.1	Inadequacies of classical physics-experimental evidences	4	4
2.2	Evidences for quantum theory-Planck's hypothesis	1	4
2.3	Foundation of quantum mechanics-wave function & probability density	3	4
2.4	Schrödinger equation-time dependent and time independent	3	5
2.5	Particle in a potential box.	1	5
2.6	Optical spectra- spectral terms, selection rules	1	6
2.7	hyperfine structure; molecular spectra-rotational, vibrational and electronic spectra	2	6
2.8	Raman effect- experimental study, quantum theory	1	6
2.9	fluorescence and phosphorescence; comparison of Raman, fluorescence and IR spectra; NMR	1	6
3.0	**Electronics**	**13**	**7**
3.1	Current-voltage characteristics of a diode-forward and reverse bias	1	7
3.2	Breakdown mechanism of p-n junction diode	1	7
3.3	Zener diode and its characteristics	1	7
3.4	Half wave and full wave rectifiers- bridge rectifier-ripple factor, efficiency	3	7
3.5	Construction and operation of a bipolar junction transistor biasing and different amplifiers with feedback	5	7
4.0	**Nuclear fission and fusion**	**7**	**8**

4.1	Nuclear fission- energy release in fission reactions- liquid drop model of fission	2	8
4.2	Chain reaction- nuclear reactor- power and breeder reactor- atom bomb	2	8
4.3	Nuclear fusion- energy production in stars	1	8
4.5	Thermo nuclear reactions in sun- p-p chain - C-N cycle	2	8

References

1. Modern Physics- R. Murugeshan, Er. Kirthiga Sivaprasad
2. Principles of electronics, V K Mehta,
3. Electricity and magnetism, D C Tayal
4. Functional Electronics, Ramanan
5. Electricity and magnetism - Brijlal and N. Subrahmanyam

Semester IV (Complementary Physics for Chemistry)
CH4C01U: Physical Optics, Laser Physics and Superconductivity

Sl. No.	Course Outcome	Cognitive Level	PSO
1	Understand the basic ideas of optics – Interference, Diffraction, Polarization.	Understand	1
2	Illustrate the principles of laser.	Understand	1
3	Understand the working principle of optic fibers and to classify it.	Understand	1
4	Explain the basic ideas of Supercondivity	Understand	1
5	Solve problems in optics	Understand	1

Course Description

Module	Course description	Hr	CO

1.0	**Interference, Diffraction and Polarization**	**22**	**1,5**
1.1	Introduction-Interference, light waves, phase difference, coherence, optical path and phase change.	1	1
1.2	Principle of superposition, young's double slit experiment, conditions for interference.	1	1
1.3	Conditions for sustained interference patterns, constuctive and destructive interference.	1	1
1.4	Thin film interference- reflected system, colour of thin films, fringes of equal inclination and equal thickness.	1	1
1.5	Newtons's rings – Reflected system – measurement of wavelength, Problems	2	1,6
1.6	Introduction – Diffraction – Fresnel and Fraunhoffer diffractions, Fresnels theory of rectilinear propagation of light, Problems	3	1,6
1.7	Fraunhoffer diffraction at single slit, width of central bright maxima.	1	1
1.8	Intensity in Fraunhoffer diffraction pattern. Problems	1	1,6
1.9	Introduction – Grating, construction and working of plane transmission grating	1	1
1.10	Determination of wavelength of light using grating.	1	1
1.11	Dispersive and resolving power of grating. Problems	2	1,6
1.12	Prism and grating spectra, rayleigh's criterion for resolution.	1	1
1.13	Introduction- Polarization, CPL, EPL and PPL	1	1
1.14	Brewster's law, Dichroism	1	1
1.15	Birefringence- E ray and O ray	1	1
1.16	Polarizer and analyser	1	1
1.17	Malu's law, optical activity	2	1
2.0	**Laser and Fiber Optics**	**10**	**2,3,5**
2.1	Introduction – Laser – Principle of operation of laser	1	2
2.2	Population inversion, metastable state, optical resonator	1	2
2.3	Components of laser – active medium, pump, optical resonant cavity	1	2
2.4	Principal pumping schemes	1	2
2.5	Three level and four level systems	1	2
2.5	Laser beam characteristics, applications of laser	1	2
2.6	Light propagation in optical fibres, Types of optical fibers- step index and graded index fibers	2	3

2.7	Acceptance angle, Numerical aperture, derivation and problems	3	3,6
3.0	**Superconductivity**	**9**	**4**
3.1	Super conducting phenomenon- Occurrence- BCS theory (qualitative)	2	4
3.2	Meissner Effect- Type I and Type II superconductors	2	4
3.3	Josephson effects- High temperature superconductors	2	4
3.4	Applications of Superconductivity	3	4

References:

1. Optics - Brijlal and N. Subrahmanyam,
2. Electricity and Magnetism , D C Tayal
3. Electricity and Magnetism- J. H. Fewkes & John Yarwood
4. Electricity and Magnetism – R. Murugeshan
5. Nuclear physics –Irvin Kaplan
6. Lasers – theory & applications- Thyagarajan & Ghatak
7. Concepts of Modern Physics- A. Beiser
8. Laser Physics and Applications, V K Jain
9. Optical Fiber Communications, John M Senior

14. Semester I &II (Complementary Physics Practical)

PH2CMP01 –Complementary Physics Practical 1

Sl. No.	Course Outcome	Cognitive Level	PSO
1.	Apply the knowledge of different types of pendulum to determine 'g'.	Understand, Apply	2,3,4,6
2.	Determine surface tension of liquid using capillary rise method.	Understand, Apply	2,3,4,6
3.	Determine moment of inertia of fly wheel.	Understand, Apply	2,3,4,6
4.	Determine the rigidity modulus of a material using static and dynamic method.	Understand, Apply	2,3,4,6
5.	Determine Young's modulus of a material.	Understand, Apply	2,3,4,6

Course Description

Sl. No	Course Description	Hrs	CO
1	Symmetric, asymmetric compound pendulum and Kater's pendulum-determination of 'g'.	4	1
2	Determination of Young's modulus of a material by uniform and non-uniform bending methods using pin and microscope method	4	5
3	Torsion pendulum-Determination of rigidity modulus	2	4
4	Determine surface tension by capillary rise method	1	2
6	Fly wheel-Determination of moment of inertia	1	3
7	Cantilever- Determination of Young's modulus	2	5
8	Static torsion- Determination of rigidity modulus	1	4

15. **Semester III & IV (Complementary Physics Practical)**

PH4CMP02: Complementary Physics Practical 2

Sl. No.	Course Outcome	Cognitive Level	PSO
1	Determine Young's modulus.	Apply	1,3,4,5
2	Calculate moment of inertia, rigidity modulus and accceleration due to gravity using different methods.	Apply	1,3,4,5
3	Determine the optical constants using different methods.	Apply	1,3,4,5
4	Carry out calibration of ammeter and voltmeter.	Apply	1,3,4,5
5	Execute and analyze characteristics of semiconducting devices and circuits.	Apply, Analyze	1,3,4,5
6	Calculate resistiviy of given material.	Apply	1,3,4,5
7	Determine the magnetic parameters.	Apply	1,3,4,5
8	Execute and differentiate logic gates.	Apply, Analyze	1,3,4,5

Course Description

Sl. No	Course description	Hrs	CO
1	Determination of Young's Modulus- Cantilever (Pin & Microscope) OR Uniform bending (pin and microscope)OR Non-uniform bending (optic lever)	2	1
2	Asymmetric Compound Pendulum- Determination of moment of inertia and Acceleration due to gravity (g)	2	2
3	Torsion pendulum (Equal mass method) - Rigidity modulus and Moment of Inertia	2	2
4	Spectrometer – Dispersive power of prism	2	3
5	Spectrometer – Dispersive power of a Grating	2	3
6	Newton's rings -Wave length	2	3
7	Characteristics of Zener diode- ac and dc resistance	2	5
8	Conversion of Galvanometer into voltmeter	2	4
9	Carey Foster's Bridge -Measurement of resistivity	2	6
10	Tangent Galvanometer – Ammeter calibration	2	4

11	Potentiometer-Calibration of low range ammeter OR voltmeter	2	4
12	Construction of full wave rectifier (center-tap OR bridge) with and without filter –Ripple factor	2	
13	Construction of regulated power supply using Zener diode- line and load regulation	2	5
14	Laser diffraction- width of single slit OR thickness of wire	2	3
15	Refractive index of liquid- Liquid Lens OR Spectrometer and Hollow Prism	2	3
16	Air wedge-thickness of wire	2	3
17	Static Torsion - Rigidity modulus	2	2
18	Deflection and Vibration Magnetometer-m & Bh	2	7
19	Field along the axis of circular coil- determination of Bh	2	7
20	Searle’s Vibration Magnetometer - magnetic moment	2	7
21	Gates – AND, OR, NOT- verification of truth tables	2	8