Scheme and Credit Structure

of

B.Sc. (H) Physics

Department of Applied Sciences

The NorthCap University

Gurugram

SCHEME OF B.Sc. (HONS) PHYSICS 2019-22

Sem	Course 1	Course 2	Course 3	Course 4	Course 5	Course 6	Lab		Contact hours	Credit
I	Waves &OscillationsPYL 101 (3-0-0)3	Maths-I ASL 101 (3-0-2) 4	Applied Mechanics PYL 103 (3-0-0)3	Electricity and Magnetism PYL 105 (3-0-0)3	Effective Communication-I CLL 101 (1-0-2) 2	Engg. Chemistry ASL 130 (2-0-2)3	Physics Lab1 (0-0-4)2	GPA 1	25	21
II	Optics PYL 102 (3-0-0)3	Mathematical Physics I PYL 104 (3-1-0)4	Solid State Physics PYL 106 (3-0-0) 3	Quantum Mechanics PYL 108 (3-0-0)3	Effective Communication-II CLL 102 (1-0-2)2	Fundamentals of Electronic Communication PYL110 (3-0-0) 3	Physics Lab2 (0-0-4)2	GPA 1	23	21
III	Electromagnetic Theory PYL 201 (3-0-0) 3	Thermal Physics PYL203 (3-0-0) 3	Statistical Mechanics PYL 205 (3-0-0) 3	Prog . Elec. I Lasers/ Nuclear, Particle and Astro physics (3-1-0)4	EVS ASL 140 (3-0-0) 3	Open Elective I (2-0-2) 3	Physics Lab3 (0-0-4)2	GPA 1	24	22
IV	Mathematical Physics II PYL202 (3-1-0) 4	Atomic and Molecular Physics PYL204 (3-1-0) 4	Polymer Composites ASL 310 (2-0-2)3	Prog .Elec. II Non Linear Optics/Biophysics (3-0-0)3	Open Elective II (2-0-2)3	----	Physics Lab4 (0-0-4)2	GPA 1	23	20
V	Numerical Analysis MAL310 (3-0-2) 4	Digital Electronics PYL 301 (3-1-0) 4	Microprocessor PYL303 (2-0-2)3	Prog .Elec.III Experimental and analytical Techniques/Fiber Optics (3-0-0)3	Open Elective III (2-0-2)3	----	Physics Lab5 (0-0-4)2	GPA 1	24	20
VI	Nuclear and Particle Physics PYL 302 (3-1-0)4	Electronic Devices PYL 304 (3-1-0)4	Prog . Elec. IV Optical Communication/ Thin films and Nanomaterials (3-0-0)3	Open Elective IV (2-0-2)3	Project (0-0-6)3			GPA 1	21	18
Total Credits									140	122

1. The overall credits structure of BSc (Hons) Physics

Credits Structure	
Category	Credits
Program Core (PC)	84
Program Electives (PE)	13
Open Electives (OE)	12
Ability Enhancement Courses (AEC)	13
TOTAL	122

A. Program Core (PC)

			L-T/P	C
1	PYL 101	Waves and Oscillations	3-0-0	3
2	ASL 101	Maths-1	3-0-2	4
3	PYL103	Applied Mechanics	3-0-0	3
4	ASL 130	Engineering Chemistry	2-0-2	3
5	PYL105	Electricity and Magnetism	3-0-0	3
6		Physics Lab1	0-0-4	2
7	PYL102	Optics	3-0-0	3
8	PYL104	Mathematical Physics I	3-1-0	4
9	PYL106	Solid State Physics	3-0-0	3
10	PYL108	Quantum Mechanics	3-0-0	3
11	PYL110	Fundamentals of Electronic Communications	3-0-0	3
12		Physics Lab2	0-0-4	2
13	PYL201	Electromagnetic Theory	3-0-0	3
14	PYL203	Thermal Physics	3-0-0	3
15	PYL205	Statistical Mechanics	3-0-0	3
16		Physics Lab3	0-0-4	2
17	PYL202	Mathematical Physics II	3-1-0	4
18	PYL204	Atomic and Molecular Physics	3-1-0	4
19	ASL310	Polymer Composites	2-0-2	3
20		Physics Lab4	0-0-4	2
21	MAL310	Numerical Analysis	3-0-2	4
22	PYL301	Digital Electronics	3-1-0	4
23	PYL303	Microprocessor	2-0-2	3
24		Physics Lab5	0-0-4	2
25	PYL302	Nuclear and Particle Physics	3-1-0	4
27	PYL304	Electronic Devices	3-1-0	4
28		Project	0-0-6	3
		Total Credits		**84**

A. Program Electives (PE)

		L-T/P	C
PE-I			
PYL205	Lasers	3-1-0	4
PYL207	Nuclear, Particle and Astrophysics	3-1-0	4
PE-II			
PYL206	Non Linear Optics	3-0-0	3
PYL208	BioPhysics	3-0-0	3
PE-III			
PYL305	Experimental and Analytical Techniques	3-0-0	3
PYL307	Fibre Optics	3-0-0	3
PE-IV			
PYL306	Thin films and Nanomaterials	3-0-0	3
PYL308	Optical Communication	3-0-0	3
B.	**Ability Enhancement Courses (AEC)**	**L-T/P**	**C**
CLL101	Effective Communication – I	1-0-2	2
CLL102	Effective Communication – II	1-0-2	2
ASL140	Environmental Studies	3-0-0	3
	GPA		6
	Total Credits		**13**

Short Syllabus for BSc (H) PHYSICS Courses (w. e. f. 2019-22)

PYL101 Waves and Oscillations (3-0-0=3 Credits) 42 Lectures

Simple Harmonic Oscillations. Differential Equation of SHM and its Solution, Superposition of Two Collinear Harmonic Oscillations, Coupled Oscillators Free Oscillations. Damped, Forced Oscillations, Helmholtz Resonator. Plane and Spherical Waves. Longitudinal and Transverse Waves. Wave Equation. Particle and Wave Velocities. Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Phase and Group Velocities. Acoustics of buildings.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To understand the basics of oscillations like simple harmonic oscillation.

CO 2 To have indepth knowledge of superposition of oscillations.

CO 3 To have basic idea of concept of wave..

CO 4 To understand the concept of superposition of waves.

PYL 103 Applied Mechanics (3-0-0 = 3 Credits) 42 Lectures

Dynamics of a System of Particles, Elastic and Inelastic Collisions between particles, Moment of Inertia, Kinetic Energy of Rotation, Inertial and Gravitational Mass, Motion of a Particle under Central Force Field, Kepler's Laws (Ideas Only), Orbits of Artificial Satellites, Reference Frames, Inertial and non-inertial frames, Galilean Invariance and Conservation Laws, Types of forces (with applications) Michelson-Morley Experiment and its Outcome. Postulates of Special Theory of Relativity, Galilean Transformations, Length Contraction, Time Dilation, Variation of Mass with Velocity, Mass energy Equivalence, Bucherer's experiment, Doppler effect.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To study different types of energy and easily differentiate between conservative and nonconservative forces.

CO 2 To determine moment of inertia for some simple body geometries.

CO 3 To study the detailed knowledge of gravitational and central force motion.

CO 4 To explore the properties inertial and non-inertial frames and different types of forces and their applications.

CO 5 To develop the understanding of non-relativistic and relativistic mechanics for applications such as in GPS.

ASL 130 Engineering Chemistry (2-0-2 = 3 Credits) 28 Lectures

Fundamental of thermodynamic, Derivation of Entropy, Gibbs Helmholtz and Clausius Clapeyron Equation. Fuel and Combustion, Catalysis, Hardness and its determination by EDTA method, alkalinity of water, Softening and desalination of water. Chemistry of Engineering Material(Cement, Polymers, Alloys and Composites), Properties and classification of lubricants, Electrochemical corrosion, factor effecting and prevention methods of corrosion. Beer Lambart law, Principal, Instrumentation and application of UV spectroscopy, IR, TGA, DTA. Conductometric titration

Chemistry lab

1. Determination of heat capacity of calorimeter for different volume.
2. To determine moisture, volatile matter & ash content of a given sample of coal.
3. Determination of Calcium and Magnesium hardness of water sample by EDTA method.
4. To determine the alkalinity of a given water sample by volumetric method.
5. To prepare Phenol – Formaldehyde (PF) and Urea – Formaldehyde (UF) resins.
6. Estimation of Calcium in Portland Cement.
7. To study the effect of temperature on viscosity of a given oil by Redwood Viscometer)
8. To find out the saponification value of coconut oil.
9. Study of corrosion of metals in medium of different pH solution using pH meter.
10. To find out the strength of the given hydrochloric acid solution by titrating it against Sodium Hydroxide solution using pH meter.
11. To find out the strength of the given hydrochloric acid solution by titrating it against Sodium Hydroxide solution conductometrically.
12. To determine the concentration of $KMnO_4$ solution using UV – Spectrophotometer.
13. To determine the amount of sodium and potassium in a given sample of water by flame photometer .
14. To draw the chemical structures of various compound using software ACD/ chemSketch .

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 Identify and formulate elementary level engineering problems related to thermodynamics and energy transformation in a conceptual form as well as in terms of mathematical models.

CO 2 Ability to characterize the fuels and understand the combustion mechanisms of various fuels

CO 3 To understand the technologies for wastewater treatment to make it suitable for human consumption and industrial application.

CO 4 To understand practices for the prevention and remediation of corrosion.

To analyze properties of lubricants utilized for application purpose.

CO 5 Explain various types of engineering material and application in various fields

CO 6 Understand the methodology for quantitative and qualitative analysis of material

PYL 105 Electricity and Magnetism (3-0-0=3 Credits) 42 Lectures

Complex Reactance and Impedance. Series LCR Circuit and Parallel LCR Circuit. Network theorems, Dielectric Properties of Matter, Dielectric Constant. Electric Susceptibility. Gauss's law in Dielectrics, Magnetic Flux. Biot-Savart's Law, Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital law (Integral and

Differential Forms): B due to (1) a Solenoid and (2) a Toroid. Properties of B. Curl and Divergence of B. Vector Potential. Gauss's law of magnetism (Integral and Differential Forms). Magnetic Susceptibility. Relation between B, M and H. Stored Magnetic Energy in Matter. Magnetic Circuit. B-H Curve and Energy Loss in Hysteresis

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To provide the basic concepts electric and magnetic fields and to provide knowledge in the instruments

CO 2 To provide adequate knowledge about industrial applications of electricity and magnetism.

CO 3 To provide adequate knowledge about dielectric properties od matter and to provide adequate knowledge about Industrial application.

CO 4 To provide adequate knowledge about magnetic properties of matter.

Physics Lab1 (0-0-4=2 Credits)

1. To use Carey Foster bridge to determine resistivity of different metals.
2. To measure the current flowing in a circuit by measuring the drop of potential across the known resistance in the circuit using a potentiometer (by measuring the resistance of potentiometer with Post office Box.
3. Determination of moment of inertia of rectangle bar about an axis passing through its centre of gravity.
4. To determine acceleration due to gravity and velocity for a freely falling body.

PYL 102 Optics (3-0-0 = 3 Credits) 42 Lectures

Fermat's Principle of Least Time or Extremum Path. Lenses, Lagrange and Helmholtz Laws of Magnification, Graphical Construction of Image using Cardinal Points. Thick Lens, Huygens Principle of Secondary Wavelets. Coherence, Interference: Newton's Rings, Michelson's Interferometer,Fresnel and Fraunhoffer diffraction, Zone plate. Fraunhoffer Diffraction Rayleigh's criterion of resolution. Resolving Power and Dispersive Power of a Plane Diffraction Grating. Holography. Recording and Reconstruction Method. Polarization by refraction and reflection, Double refraction, Nicol prism, Quarter and half wave plates, Laurent's half shade polarimeter, Applications of polarization in chemical industry

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To understand the basics of optics.

CO 2 To have indepth knowledge of interference and its applications in research and industries.

CO 3 To have basic and advance idea of different types of diffraction, resolving and dispersive power of grating and its applications.

CO 4 To understand the concept of holography being widely used in security and decoration which is useful for the mankind?

CO 5 To have understanding of polarization and its applications in industries.

PYL104 Mathematical Physics I (3-1-0=4 Credits) 42 Lectures

Vector Differentiation, Divergence and Curl of a Vector Field, Del and Laplacian Operators. Line, Surface and Volume Integrals. Gauss' Divergence Theorem, Green's Theorem and Stokes Theorem, Orthogonal Curvilinear Coordinates. Derivation of Gradient, Double and Triple Integrals (with examples), Beta and Gamma Functions and Relation between them, Systematic and Random Errors, Fourier Series, Kronecker's Method for Computation of Fourier Coefficients.Orthogonality of Sine and Cosine Functions. Sine and Cosine Series. Differentiation and Integration of a Fourier series (with examples).

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To study the vector differentiation, integration and different types of operators.

CO 2 To determine the divergence, curl and Laplacian in various types of coordinates system.

CO 3 To explore the properties of multiple integrals and their applications.

CO 4 To determine the different types of errors and their propagations.

CO 5 To study the detailed knowledge about Fouries series, sine and cosine function and their applications.

PYL 106 Solid State Physics (3-0-0 = 3 Credits) 42 Lectures

Crystal Lattice, Reciprocal Lattice, Bragg's Law, Phonons, Einstein and Debye Theories of Specific Heat of Solids. Classical Langevin Theory of dia – and Paramagnetic Domains. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains, Discussion of B-H Curve, Polarization. Clausius-Mosotti Equation, Elementary Band Theory of Solids, Kronig-Penney Model, Effective Mass of Electron, Direct and Indirect Band Gap Semiconductors. Hall Effect in Semiconductors (Qualitative Discussion Only). Superconductivity, London's Equation Isotope effect. Ideas of BCS theory (No derivation): Experimental Evidence of Phonons Josephson Effect.

Course Outcomes (COs)

Student will have complete knowledge and understanding of structure of solids and their thermal, dielectric magnetic and electronic properties as mentioned in COs below. They can apply this learning in a large number of electronic, magnetic, dielectric devices such as electromagnets, magnetic cores, memories, electroacoustic transducers, piezoelectric devices, transistors, solar cells, LEDs, photodiodes, etc. which have their design and performance dependent on the properties of various solids.

CO 1 Crystal lattice, types of lattices and types of bonds in lattices, structure parameters and indices, X-ray diffraction for structure determination, etc.

CO 2 Lattice vibrations and phonons, phonon spectra and theory of specific heat of solids.

CO 3 Magnetic properties of solids including dia-, para and ferro-magnetism, Curie – Weiss Law, ferromagnetic domains, hysteresis etc.

CO 4 Dielectric properties of solids. Relation between polarizability and dielectric constant, dielectric dispersion, etc.

CO 5 Band theory of solids, Kronig-Penney relation, energy band diagrams, concept of effective mass and holes, classification into metals, semiconductors and insulators, Hall mobility, etc.

CO 6 Superconductivity, Meissner effect, Ideas of BCS theory, Josephson effect, etc.

PYL 108 Quantum Mechanics (3-0-0 = 3 Credits) 42 Lectures

Introduction to Quantum Mechanics: Failures of classical mechanics, wave nature of particles, discreteness of energy levels, Postulates and Operators in Quantum Mechanics: The basic postulates of quantum mechanics, properties, physical significance and Born interpretation of wave functions ,operators, commutator algebra [x, px], [y, py], eigen values and eigen vectors of an operator, Ehrenfest theorem. Schrodinger Equation-I:Time dependent and independent Schrodinger equations. One dimensional problems. Schrodinger Equation-II: Schrodinger equation for two particles, Schrodinger equation in spherical coordinates with central potential, orbital angular momentum operators and their communication relations, eigen values and eigen functions of L2 and Lz, Schrodinger equation for hydrogen like atoms.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To explain the inadequacies of classical mechanics

CO 2 To explain the wave particle duality of particle

CO 3 To explain the basic postulates of quantum mechanics

CO 4 To apply the different operators used in quantum mechanics

CO 5 To apply time dependent and independent Schrodinger equation

CO6 To explain Schrodinger equation in a spherical potential

PYL110 Fundamentals of Electronic Communication (3-0-0= 3 Credits) 42 Lectures

Introduction to Communication System, Modulation and Demodulation techniques, Antenna and Radio Wave Propagation, Radio receiver and Television, Telephone System, Satellite communication, GPS.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 Acquired knowledge about basic analog and digital communication

CO 2 Knowledge about technology used in communication

CO 3 Capable of performing various antenna measurements

CO 4 Ability to identify characteristics of radio wave propagation

CO 5 To learn about basic telephone system

Physics Lab2 (0-0-4=2 Credit)

1. To determine the surface tension of a liquid by capillary rise method.
2. To determine the refractive index of liquid by Newton rings using sodium light.
3. To determine the dispersive power of material using mercury lamp.
4. To determine wavelength of sodium light using Fresnel biprism.
5. To determine wavelength of Laser using diffraction grating.
6. To determine the specific rotation of sugar solution using Laurent's half shade device.

7. To verify Brewster law.
8. Determination of wavelength of various colors using diffraction grating.
9. To determine the Planck constant by using the LEDs.
10. To determine the band gap and Hall mobility of a semiconductor by four probe method and by optical method
11. To study B-H curve of different materials using CRO.

PYL 201 Electromagnetic Theory (3-0-0 = 3 Credits) 42 Lectures

Maxwell equations, vector and scalar potentials. Gauge Transformations,wave equations, Poynting theorem and Poynting vector, Electromagnetic energy density. Reflection and Refraction of Electromagnetic Waves, Waves in Conducting Media, Skin Depth.Maxwell's Equations in Microscopic Media (Plasma). Polarization of Electromagnetic Waves: Propagation of e.m. Waves in Anisotropic Media. Numerical aperture of optical fiber, types of fibres (Concept and Definition Only), Planar Optical Wave Guides. Phase and Group Velocity of the Guided Waves. Field Energy and Power Transmission.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To write Maxwell's electromagnetic equations

CO 2 To explain the reflections and transmission of electromagnetic waves in different media.

CO 3 To explain the polarization of electromagnetic waves

CO 4 To explain the propagation of electromagnetic wave in optical fibre

CO 5 To explain the optical wave guide

PYL203 Thermal Physics (3-0-0 = 3 Credits) 42 Lectures

Zeroth and First Law of Thermodynamics, State Functions, First Law and Various Processes. Work Done during Isothermal and Adiabatic Processes.Compressibility and Expansion Coefficient. Atmosphere and Adiabatic Lapse Rate, Heat Engines, Carnot Cycle. Second Law of Thermodynamics,Carnot Theorem. Applications of Second Law of Thermodynamics (with applications), Entropy, Clausius Theorem, Law of Thermodynamics in terms of Entropy. Entropy Changes in Reversible and Irreversible Processes. Third Law of Thermodynamics. Maxwell's Thermodynamic Relations, Distribution of Velocities, Emissivity in different wavelengths.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To explain the different laws of thermodynamics

CO 2 To explain the Carnot's cycle and applications of second law of thermodynamics

CO 3 To explain entropy and phase transitions.

CO 4 To write Maxwell's thermodynamical relations and apply them to different physical phenomena

CO 5 To explain the kinetic theory of gases

PYL 205 Statistical Mechanics (3-0-0 = 3 Credits) 42 Lectures

Kinetic theory of gases, ideal gas equation, Van der Waals equation, mean free path, transport phenomena, etc. Entropy and Probability, Maxwell-Boltzmann Distribution Law, Partition Functions, Thermodynamics of state variables and their derivatives, Planck's Law of Blackbody Radiation, Stefan-Boltzmann Law, Bose-Einstein Statistics. BE condensation, Saha's Ionization Theory, Fermi-Dirac Statistics and Distribution Law, Degenerate Fermi Gas, Specific Heat of Metals. White Dwarf Stars. Chandrasekhar Mass Limit.

Course Outcomes (COs)

This course gives an understanding of microscopic nature of thermal processes taking place in materials as per the following COs. On successful completion of the course, the students will be able to apply their learning to analyze solve practical and theoretical problems related matter radiation interaction, specific heat of materials, problems of diffusion and heat conduction, super-fluidity of helium, white dwarf, etc.

CO 1 kinetic theory of gases, ideal gas equation, Van der Waals equation, mean free path, transport phenomena, etc.

CO 2 Thermos-dynamic state properties of classical physical systems statistics of particle energy distribution in classical and quantum systems including M-B, B-E and F-D distributions.

CO 3 the laws of black-body radiation and understanding of quantum nature of electromagnetic radiations

CO 4 Bose-Einstein condensation its role in understanding of a number of physical phenomena including properties of liquid helium

CO 5 Fermi energy and degenerate Fermi gas and their role in understanding of a number of physical phenomena including properties of specific heat, helium III, white dwarf, etc.

Physics Lab3 (0-0-4=2 Credits)

1. To determine the velocity of light of different wavelengths and polarisations as a quotient of optical path travelled by a light pulse and the transit time.
2. To study the variation of magnetic field along the axis of a circular coil carrying current and extimate the radius of the coil.
3. To demonstrate dia, para, ferromagnetism in homogeneous magnetic field.
4. To determine the specific heat capacity of solid using copper, lead and glass.
5. To determine the Stefan's constant.
6. To determine wavelength and velocity of ultrasonic wave in liquid.
7. Determination of thermal conductivity of different materials by Lee's method.

PYL202 Mathematical Physics II (3-1-0=4 Credits) 42 Lectures

Differential Equations and its Classification, Linear Ordinary Differential Equations First and second order (with examples from vibrations, heat conduction, diffusion etc.), Solution of Non-homogeneous Equations by D Operator Method. Bernoulli and Euler Equations. Coupled Differential Equations, Euler's Equation and its Application to Simple Problems, Hamilton's Principle. Poisson Brackets and their Properties.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To study the basics of differential equation and their classifications.
CO 2 To solve linear differential equation for various problems.
CO 3 To explore the properties of second order differential equations.
CO 4 To determine the different types of equations and their applications.
CO 5 To study the detailed knowledge about Lagrange Multipliers and their applications.

PYL204 Atomic and Molecular Physics (3-1-0 = 4 Credits) 42 Lectures

Determination of e/m of the Electrons, Mass spectrometry. X-rays Ionizing Power, Moseley Law. angular momentum, associated magnetic moment, Larmor precession Theorem, Stern-Gerlach Experiment, Zeeman Effect, Stark Effects (Qualitative Discussion only), Pauli's Exclusion Principle, Fine structure, Hund's Rule, Spectra of Hydrogen and Alkali Atoms (Na etc.), Doppler broadening, Rotational Energy and Vibrational Energy Levels, Raman Effect, Quantum Theory. Stoke's and Anti-Stoke's Lines, Lasers: Einstein's A and B coefficients, Metastable states, Optical Pumping and Population Inversion. Ruby Laser and He-Ne Laser.

Course Outcomes (COs)

The learning gained as per the following COs will enable analyze XRD and XRF, infra-red and optical spectra, Raman spectra of materials These applications are crucial in analysis and synthesis of materials.

CO 1 e/m ratio of electrons, isotopes, isobars. Mass spectrometry, X-rays diffraction (XRD) and X-ray spectroscopy (XRF).

CO 2 orbital and spin quantization of electron angular momentum, associated magnetic moment, Larmor precession, various effects associated with electron magnetic moment in external magnetic and electric fields.

CO 3 Pauli-exclusion principle, Electron distribution in elements and Periodic table. Spectra of hydrogen and alkali atoms.

CO 4 Various degrees of freedom of molecular motion, associated energy levels and molecular spectra.

CO 5 Raman effect, theory, spectra and comparison with infrared spectra.

CO 6 Principle of laser, components of laser, characteristics and ruby, He-Ne lasers.

ASL310 Polymer Composite (2-0-2= 3Credits) 28 Lectures

Fundament of polymer materials, mechanism of polymerization, classification of composites, natural fibres (jute, cellulose), carbon fibres, resins, characterization methods of polymer and composites such as (TGA, DTA, IR, NMR, UV-visible), Mechanical properties of polymer and composites (tensile strength, modulus, shear strength etc). Application of Polymer Composite in various industries; Textile, Automobile, Aerospace, Building and Construction. Project work and case studies.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 Students would be aware of the basic concepts of polymers, polymerization process and relate examples with daily life applications.

CO 2 Students would be aware of the basic concepts of composites and process to form polymer composites using different fibers. This knowledge would be useful for industry and technology perspectives..

CO 3 Student would understand the various properties of polymer and composites and the analytical techniques which can use for the identification of composites materials.

CO 4 Students would be able to correlate the application of polymer technology to industries.

Physics Lab4 (0-0-4=2 Credit)

1. To study the characteristics of a photovoltaic cell.
2. To determine the angular spread of He-Ne laser.
3. To determine the wavelength of laser using diffraction grating.
4. To determine the thickness of hair using laser.
5. To find the roots of differential equation (computation).

MAL 310 Numerical Analysis (3-0-2 = 4 Credits) 42 Lectures

Numerical solutions of algebraic and transcendental equations, Interpolation, Numerical Quadrature, System of linear equations, Numerical solution of ordinary differential equations of first order.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 Students should be able to understand numerical solutions of non-linear/ transcendental equations.

CO 2 Students should be able to apply various algorithms to solve system of linear equations.

CO 3 Students should be able to approximate mathematical functions and find intermediate values using interpolation techniques.

CO 4 Students should be able to apply numerical techniques for differentiating and integrating the non-analytical functions

CO 5 Students should be able to apply numerical techniques to solve various differential equations of engineering importance

PYL 301 Digital Electronics (3-1-0 = 4 Credits) 42 Lectures

Block Diagram of CRO. Electron Gun, Deflection System and Time Base, Applications of CRO, Integrated Circuits (Qualitative Treatment only) :- Active and Passive components. DiscreteCircuit Component. Wafer. Chip. Advantages and Drawbacks of ICs. Scale of integration :SSI, MSI, LSI and VLSI Classification of ICs. Fabrication of Components on Monolithic ICs. Examples of Linear and Digital ICs. Operational Amplifiers, Operational Amplifiers Timers and its Applications , Difference Between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. AND, OR and NOT Gates , NAND AND NOR Gates. Exclusive OR and Exclusive NOR Gates. Boolean algebra, De Morgan's Theorems, Simplification of Logic Circuit using Boolean Algebra,Fundamental Products, Minterms and Maxterms, Karnaugh Map, Data processing Memories (ROM), PROM, EPROM, Arithmetic Circuits , Sequential Circuits , Shift registers Counters , D/A and A/D conversion

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To understand CRO.

CO 2 To have in-depth knowledge of analog circuits.

CO 3 To have in-depth knowledge of digital circuits.

CO 4 To understand principle of operational amplifier and its use.

PYL 303 Microprocessor (2-0-2 = 3 Credits) 28Lectures

Hexadecimal Number System and Arithmetic. Computer organization. Input / Output

Devices. Data Storage. Computer Memory. Memory Organization and Addressing. Memory Interfacing. Memory Map. Intel 8085 Microprocessor Architecture Main Features of 8085. Block Diagram. Components. Pin-out Diagram. Buses. Registers. ALU. Memory. Stack Memory. Interfacing Devices. Timing and Control Circuitry. Timing States. Instruction Cycle (Timing Diagram). Interrupts and Interrupt Control. Input / Output.

8085 Instructions :- Instructions. Machine Language. Assembly Language. Instruction Set and Format. Data Transfer, Arithmetic, Logical, Branching and Machine Control Operations. RIM and SIM. Addressing Modes : Register, Implied, Immediate, Direct and Indirect. Microprocessor Programming :- Algorithm and Flowcharts. Simple programming Exercises : Addition, Subtraction, Multiplication and Division - Both 8 and 16 bit etc.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 Identify the basic elements and functions of 8085 and 8086 microprocessors

CO 2 Explain the architecture and operation of 8085 and 8086 microprocessors

CO 3 Understand the instruction sets of 8085 and 8086 and identify timing sequence of different instructions

CO 4 Apply the programming techniques in designing simple assembly language programs for solving simple problems by using instruction sets of microprocessors

CO 5 Identify and explain the operations of peripherals and memories typically interfaced with microprocessors

CO 6 Review some advancements in latest technological trends through features of current and advanced microprocessors

Physics Lab5 (0-0-4=2 Credit)

1. To verify and design AND, OR, NOT and XOR gates using NAND gates.
2. To design a combinational logic system for a specified Truth Table.
3. To design a Seven-Segment Display driver.
4. Half Adder, Full Adder and 4-bit Binary Adder.
5. Half Subtractor, Full Subtractor, Adder-Subtractor using Full Adder I.C.
6. To build Flip-Flop Circuits using elementary gates (RS, Clocked RS, D-type, and JK Flip-Flop).
7. To build a 4-bit Counter using D-type/JK Flip-Flop.
8. To make a Shift Register from D-type/JK Flip-Flop. 4. Serial and Parallel shifting of data.
9. To covert Voltmeter to Ammeter and vice versa. (Electricity and Magnetism)

PYL 302 Nuclear and Particle Physics (3-1-0 = 4 Credits) 42 Lectures

Structure of nuclei, Radioactivity, Binding Energy, Mass Formula., α-decay, Geiger-Nuttal law and α-particle Spectra, β-decay, γ-decay, Nuclear Reactions, Concept of Compound and Direct Reaction, Attractive and Repulsive Potential Barriers. Scattering Cross-section, Q-value of Reaction, Fission and Fusion, Nuclear Models, Van de Graaff Generator, Linear

Accelerator, Cyclotron, Betatron, and Light and Heavy Ion Synchro-Cyclotron. Idea of Large Hadron Collider, Ionization chamber, GM Counter, Scintillation Detectors, Elementary Particles, Supermultiplets of Mesons and Baryons, Conservation Laws and Symmetry, Different Types of Quarks and Quark Contents of Spin, Baryons, Photons, Gravitons, Gluons, Idea of Standard Model, Higg's Boson.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To study the depth knowledge of structure of nuclei i.e its mass, stability, binding energy etc.

CO 2 To distinguish between alpha, beta and gamma decay and study their energy spectra.

CO 3 To study the different types of nuclear reactions, nuclear models and their advantages.

CO 4 To identify the different types of acceralators, detectors and their industrial applications.

CO 5 To study the different types of particles and antiparticles and their classification.

Physics Lab6 (0-0-6=3 Credits)

Project

PYL 304 Electronic Devices (3-1-0 = 4 Credits) 42 Lectures

Circuit Analysis, Wheatstone Bridge and its Applications. Semiconductor Diodes Barrier Potential, Barrier Width and Current for Step Junction. pn junction and its characteristics, Static and Dynamic Resistance, Diode Equivalent Circuit, Ideal Diode, Load Line Analysis of Diodes.Load Line and Q-point, Rectifiers, Zener Diode and Voltage Regulation Photo Diode, Tunnel Diode, LED , Varactor Diode. Bipolar Junction transistors Current gains, Load Line Analysis Q-point. Amplifiers. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Resistance,Voltage and Power Gains. Class A, B, and C Amplifiers., Coupled Amplifiers , Feedback in Amplifiers, Sinusoidal, Hartley Oscillator. Colpitts Oscillator., Non-Sinusoidal Oscillators – Astable and Monostable Multivibrators. UJT : Its Chararacteristics and Equivalent Circuit, Relaxation Oscillator, JEFT : Its Characteristics and Equivalent Circuit. Advantagesof JFET. MOSFET Modulation and Demodulation

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To understand the basics of bridges

CO 2 To have in depth knowledge of diodes

CO 3 To have basic idea of amplifications

CO 4 To understand the oscillators

Programme Electives

PE-1

PYL 205: Lasers (3-1-0=4 Credits) 42 Lectures

Introduction to lasers **:**Threshold condition - Requirements for obtaining population inversion Steady state and transient population processes. Condition for laser action, Types of lasers, Injection laser - Threshold current - Homojunction – Hetrojunction - Double hetrojunction lasers - Liquid lasers - Pulsed-CW dye laser - Threshold condition - Configuration - Tuning methods. Applications of lasers.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To provide the basic concepts Lasers and to provide working knowledge in the instruments

CO 2 To provide adequate knowledge about industrial applications of Lasers.

CO 3 To provide adequate knowledge about lasing condition and population inversion

CO 4 To provide adequate knowledge about tuning methods.

PYL 207: Nuclear, Particle and Astrophysics (3—1-0=4 Credits) 42 Lectures

Properties of Nuclues: General properties of the atomic nuclei, nuclear charge, elementary idea of nuclear fission and fusion. Qualitative discussion of the nature of nuclear forces.**Radioactive Decay and Interaction of Nuclear Radiation with Matter :**Radioactive series decay, Qualitative discussion of alpha, beta and gamma-decays, Nuclear radiation detectors **Particle Physics:** Basic interactions and their mediating quanta, classification of particles, idea of resonances, conservation rules in fundamental interactions, determination of spin and parity of pions, strange particles, isospin and its conservation, quarks, their quantum numbers and quark model. **Cosmic Rays and Astrophysics** Primary cosmic rays, Production secondary cosmic rays, Structure of the sun, stellar energy source, p-p and C-N-O cycles and their temperature dependence, H-R diagram, white dwarf and Chandrasekhar mass limit, neutron star and pulsar, Schwarzschild radius and Black Holes.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To explain the different properties of atomic nuclei and nature of nuclear forces

CO 2 To explain radioactive decay and interaction of nuclear radiation with matter

CO 3 To classify particles and explain the conservation rule in fundamental interactions

CO 4 To explain the primary cosmic rays and production of secondary cosmic rays.

CO 5 To explain different astrophysical phenomena

PE-II

PYL206 Nonlinear Optics (3-0-0=3 Credits) 42 Lectures

Light matter interaction, Nonlinear perturbation theory and coupled mode equations, Anharmonic oscillator model, second and third order effects, phase-matching mechanisms, vibrational transitions in molecules and Raman-nonlinearity, Kerr nonlinearity.

Course Outcomes (COs)

After the successful completion of the course, the students will be able to;

CO 1 Understand the light matter interaction and origin of Nonlinear optics (NLO).

CO 2 Have indepth knowledge of optical processes of NLO,having the potential of industrial applications.

CO 3 Understand the scattering of light at high intensity.

CO 4 Know about intensity dependent refractive index and various types of nonlinearities for technological importance.

PYL208 Biophysics (3-0-0 = 3 Credits) 42 Lectures

Advanced Nuclear Magnetic Resonance, Biomolecular structure determinations, Microscopy, Fluorescence,Tomography & 3D single-particle reconstruction, Analysis of structure using Electrostatics - potentials & pKs, Molecular Dynamics, Mass Spectrometry, Theory & instrumentation, Footprinting & dynamics

Course Outcomes (COs)

After successful completion of the course students will be able to

CO 1 Attain the understanding of magnetic resonance and its applications.

CO 2 Know the role of physics in biological materials.

CO 3 Analyze the structure of biomolecules and its applications in medical fields.

CO 4 Have understanding of interaction of radiation with biomaterial.

PE-III

PYL305: Experimental and analytical Techniques (3-0-0=3 credits) 42 Lectures

Crystalline Semiconductors: Growth, Diffusion, ion implantation, oxidation, microlithography, plasma etching, thin film deposition, Introduction to compound semiconductors.

UV-VIS/IR spectrophotometer, Raman spectroscopy, X-ray diffraction, LCR meter, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning Tunneling Microscopy (STM), Scanning Force Microscopy (SFM), Atomic Force Microscopy (AFM), Z-Scan.

Course Outcomes (COs)

Possible usefulness of this course after its completion

CO 1 Students will be able to have indepth knowledge of crystals and XRD

CO 2 Students will be having understanding of growth of crystalline semi conductors.

CO 3 Students will beapply the knowledge of analytical techniques for material characterization. in industries

CO 4 The spectroscopic techniques will be well understood and can be implemented in industry and in medical applications.

PYL307:Fiber Optics (3-0-0=3 credits) 42 Lectures

Optical fibers and their properties, Different types of fiber and their properties, Losses, Optical detector, Principles of photo detection, Industrial applications of optical fibers: Fiber optic sensors, Fiber optic instrumentation system, modulators, Holography & applications: Holography – Basic principles, Methods of holographic interferometry and applications, Holography for NDT, Medical application of lasers.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To provide the basic concepts of optical fibers and to provide knowledge about optical sources and optical detectors

CO 2 To provide adequate knowledge about industrial applications of optical fibers.

CO 3 To provide adequate knowledge about Laser fundamentals and to provide adequate knowledge about Industrial application of lasers.

CO 4 To provide adequate knowledge about holography & Medical applications of Lasers.

PE-IV

PYL 308: Optical Communication (3-0-0=3 Credits) 42 Lectures

Introduction to optical communications, ray theory, geometrical optics approach, wave theory approach, types of fiber, modes in step and graded index fiber, losses in fiber-linear and non-linear losses, Solutions, optical sources-and detectors with their working principle and characteristics, various receiver configuration-direct detection, homodyne, hetrodyne receivers, noise sources in optical communication, optical fiber link design, optical components: optical switches, SOA, EDFA, mux/demux, couplers, introduction to optical space communication, fiber in local loop.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To provide the basic concepts of optical fibers and to provide knowledge about optical sources and optical detectors

CO 2 To provide adequate knowledge about industrial applications of optical fibers.

CO 3 To provide adequate knowledge about Laser fundamentals and to provide adequate knowledge about Industrial application of lasers.

CO 4 To provide adequate knowledge about holography & Medical applications of Lasers.

PYL306: Thin Films and Nanomaterials (3-0-0=3 Credits) 42 Lectures

Vaccum and deposition technologies, Growth of thin films and low dimensional materials, Basic understanding of Nanoscience and Nanotechnology, Quantum Confinement. Quantum Dot, Quantum Wire, Nanorods, metallic nanoparticles, graphene and graphene oxide, semiconductor quantum dots nanocrystals, Porous Silicon, Aerogels, Nanoshells, Nanofluids, Carbon Nanotubes, Fullerenes, Graphenes. Dangling Bonds, Properties of nanomaterials, Linear

and Nonlinear Optical Properties of Nanomaterials, Synthesis of nanomaterials. Characterization of nanomaterials. Applications of nanomaterials.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To understand the basics of nanomaterials by simple concepts of Quantum mechanics.

CO 2 To categories different types of nanomaterials and its applications.

CO 3 To gain good knowledge of properties of nanomaterials.

CO 4 To explore the different techniques for synthesis of nanomaterials.

CO 5 To have indepth knowledge of characterization techniques of various nanomaterials.

Department of Applied Sciences

ASL140 Environmental Studies (3-0-0 = 3 Credits) 42 Lectures

The Multidisciplinary nature of environmental studies, Natural Resources, Ecosystem, Biodiversity and its conservations, Environmental Pollution, Social issues and the Environment, Human population and the Environment, Field Work.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 Application of knowledge gained to generate awareness for environmental protection so as to sensitize the student community towards environmental management and becoming Green Citizens and to apply the knowledge gained in sustaining various resources by using green technologies.

CO 2 To apply the concepts learnt in maintaining balance in natural ecosystems and it covers all aspects of life and contributes in constructive decision-making keeping environment in view.

CO 3 Development of understanding of pollution and to develop an understanding of Environmental management to enable them in becoming green engineers and green managers. To become green citizens and contribute in the sustainable development of the society, country and the world.

CO 4 To apply the concepts learnt in earning resources for their organizations by using green technologies.

CO 5 It encapsulates sound theoretical base of all the environmental aspects coupled with practical and projects.

ASL 101 Maths-1 (3-0-2 = 4 Credits) 42 Lectures

Convergence and divergence, comparison tests, D' Alembert's ratio test, integral test, Raabe's test, logarithmic and Cauchy root tests, Gauss's Test, alternating series, absolute convergence. Taylor's and Maclaurin's series, partial derivatives, Jacobians, higher order partial derivatives, homogeneous functions, Euler's Theorem and applications, Taylor's series for functions of two variables (without proof), Lagrange's method of undetermined multipliers, differentiation under integral sign (Leibnitz rule). Double integral, change of order of integration, triple integral, change of variables, volume of solids, Dirichlet's integral , Application in finding center of gravity and moment of inertia. Differentiation of vectors, scalar and vector point functions. Gradient of a scalar field and directional derivative,

divergence and curl of a vector field and their physical interpretations. Integration of vectors, Green, Stoke's and Gauss theorems (without proof) and their applications.

Center for Language Learning

CLL101 Effective Communication- I (1-0-2 = 2 Credits) 14 Lectures

Vocabulary-1, Word building and enriching vocabulary Essentials of Grammar-1 Errors pertaining to Nouns, Pronouns, Verbs, Adverbs and Adjectives Writing Skills-1 Business Correspondence, Reading Skills-1 Theme detection, Literal comprehension Speaking Skills-1: Introducing oneself mini presentation, collaborative task, Listening Skills-1: Listening specific information, theme detection, gap filling.

CLL102 Effective Communication- II (1-0-2 = 2 Credits) 14 Lectures

Vocabulary-2 Technical vocabulary, foreign expressions. Essentials of Grammar-2 Errors pertaining to Articles, Prepositions, Non-finites and conjunctions. Writing Skills-2 Resume Writing, Reports and Proposals. Reading Skills-2 Analytical reading, Reading for cohesion and proof reading Speaking Skills-2 Group Discussion, Role playing activities, Public speaking, Simulated conversation, Facing Interview, Presentation skills, Business etiquette. Listening Skills-2 Listening short pieces for gist and analytical comprehension.

SCHEME OF B.Sc. (HONS) PHYSICS 2018-21

Sem	Course 1	Course 2	Course 3	Course 4	Course 5	Cours
I	Waves & Oscillations PYL101 (3-0-0)3	Mathematical Physics I PYL104 (3-1-0)4	Applied Mechanics PYL103 (3-1-0)4	Electricity and Magnetism PYL105 (3-0-2)4	Effective Communication-I CLL101 (1-0-2) 2	Engg. Ch CHL (2-0-
II	Optics PYL102 (3-1-2) 5	Leadership SML150 (2 1 0) 3	Solid State Physics PYL 106 (3-0-2) 4	Quantum Mechanics PYL108 (3-0-0)3	Effective Communication-II CLL 102 (1-0-2)2	
III	Electromagnetic Theory PYL 201 (3-0-2) 4	Thermal Physics PYL203 (3-0-2) 4	Statistical Mechanics PYL 205 (3-1-0) 4	Prog . Elec. I Lasers/ Nuclear, Particle and Astro physics/ Fundamentals of Electronic Communication PYL110 (3-1-0)4	EVS CHL100 (3-0-0) 3	Open El (1 2
IV	Atomic and Molecular Physics PYL204 (3-1-2) 5	Entrepreneurship SML300 (2 1 0) 3	Prog .Elec. II Non Linear Optics/Biophysics/ Polymer Composites CHL350 (3-0-2)4	Open Elective II (3)3	CLL 120 Human Values (2-0-0)2	Foreign L Elec (1 2
V	Numerical Analysis MAL310 (3-0-2) 4	Digital Electronics PYL 301 (3-1-2) 5	Prog .Elec.III (MOOC) Experimental and analytical Techniques/Fiber Optics/Microprocessor PYL303 (3-0-2)4	Open Elective III (3)3	Mathematical Physics II PYL202 (3-1-0) 4	
VI	Nuclear and Particle Physics PYL302 (3-1-0)4	Electronic Devices PYL304 (3-1-0)4	Prog . Elec. IV (MOOC) Optical Communication/Thin films and Nanomaterials (3-0-2)4	Open Elective IV (3)3	Project (0-0-6)3	Creativ innov outc (1
Total						

The overall credits structure of BSc (Hons) Physics

Credits Structure	
Category	**Credits**
Program Core (PC)	68
Program Electives (PE)	16
Open Electives (OE)	12
Ability Enhancement Courses (AEC)	18
General Proficiency	6
Project based learning	4
TOTAL	**124**

A. Program Core (PC)

S N	Code	Course Name	L-T-P	Credits
1	PYL 101	Waves and Oscillations	3-0-0	3
2	PYL104	Mathematical Physics 1	3-1-0	4
3	PYL103	Applied Mechanics	3-0-2	4
4	PYL105	Electricity and Magnetism	3-0-2	4
5	CHL150	Engineering Chemistry	2-0-2	3
6	PYL102	Optics	3-1-2	5
7	PYL106	Solid State Physics	3-0-2	4
8	PYL108	Quantum Mechanics	3-0-0	3
9	PYL201	Electromagnetic Theory	3-0-2	4
10	PYL203	Thermal Physics	3-0-2	4
11	PYL205	Statistical Mechanics	3-1-0	4
12	PYL204	Atomic and Molecular Physics	3-1-2	5
13	MAL310	Numerical Analysis	3-0-2	4
14	PYL301	Digital Electronics	3-1-2	5
15	PYL202	Mathematical Physics II	3-1-0	4
16	PYL302	Nuclear and Particle Physics	3-1-0	4
17	PYL304	Electronic Devices	3-1-0	4
		Total Credits		**68**

B. Program Electives (PE)

PE-I			
PYL309	Lasers	3-1-0	4
PYL207	Nuclear, Particle and Astrophysics	3-1-0	4
PYL110	Fundamentals of Electronic Communication	3-1-0	4
PE-II			
PYL206	Non Linear Optics	3-0-2	4
PYL208	BioPhysics	3-0-2	4
CHL350	Polymer Composite	3-0-2	4
PE-III			
PYL305	Experimental and Analytical Techniques	3-0-2	4
PYL307	Fibre Optics	3-0-2	4
PYL303	Microprocessor	3-0-2	4
PE-IV			
PYL306	Thin films and Nanomaterials	3-0-2	4
PYL308	Optical Communication	3-0-2	4

C. Ability Enhancement Courses (AEC) L-T-P

CLL101	Effective Communication – I	1-0-2	2
CLL102	Effective Communication – II	1-0-2	2
CLL120	Human Values	2-0-0	2
SML 300	Entrepreneurship	2-1-0	3
SML150	Leadership	2-1-0	3
CHL100	Environmental Sciences	3-0-0	3
	Foreign Language Elective	2-0-2	3
	Total Credits		**18**

D.Project

Project	0-0-6	3
Creativity and innovation outcome		1

PYL101 WAVES AND OSCILLATIONS

(3-0=3 Credits)

SHM, Simple Harmonic Oscillations. Differential Equation of SHM and its Solution, Free Oscillations of Systems with One Degree of Freedom, Superposition of Two Collinear Harmonic Oscillations, Superposition of Two Perpendicular Harmonic System with Two Degrees of Freedom : Coupled Oscillators Free Oscillations. Damped , Forced Oscillations : Transient and Steady States, Resonance, Sharpness of Resonance, Power Dissipation and Quality Factor. Helmholtz Resonator.

Wave Motion :- Plane and Spherical Waves. Longitudinal and Transverse Waves. Wave Equation. Particle and Wave Velocities. Velocity of Waves :- Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Superposition of Two Harmonic Waves :- Standing (Stationary) Waves in a String : Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

To understand the basics of oscillations like simple harmonic oscillation.

To have indepth knowledge of superposition of oscillations.

To have basic idea of concept of wave..

To understand the concept of superposition of waves.

PYL102 OPTICS

(3-0-2 = 4 Credits) 42 Lectures

Format's Principle of Least Time or Extremum Path. Lenses, Lagrange and Helmholtz Laws of Magnification, Graphical Construction of Image using Cardinal Points. Thick Lens, Huygens Principle of Secondary Wavelets. Coherence, Interference: Division of Amplitude and Division of Wavefront, Interference in Thin Films, Fringes of Equal Inclination (Haidinger Fringes) and Fringes of Equal Thickness (Fizeau Fringes). Newton's Rings, Michelson's Interferometer,Fresnel and Fraunhoffer diffraction, Zone plate. Fraunhoffer Diffraction due to (1) a Single Slit (2) a Plane Transmission Grating. Rayleigh's criterion of resolution. Resolving Power and Dispersive Power of a Plane Diffraction Grating. Principle of Holography. Recording and Reconstruction Method. Theory of Holography as Interference between two Plane Waves. Polarization by refraction and reflection, Double refraction, Nicol prism, Quarter and halfwave plates, Laurent's half shade polarimeter, Applications of polarization in chemical industry

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To understand the basics of optics.

CO 2 To have indepth knowledge of interference and its applications in research and industries.

CO 3 To have basic and advance idea of different types of diffraction, resolving and dispersive power of grating and its applications.

CO 4 To understand the concept of holography being widely used in security and decoration which is useful for the mankind?

CO 5 To have understanding of polarization and its applications in industries.

PYL103 APPLIED MECHANICS

(3-1-0 = 3 Credits)

Dynamics of a System of Particles, Centre of Mass, Conservation of Momentum, Work and Energy Theorem, Conservative and Non-Conservative Forces, Work done by Non-conservative Forces, Law of Conservation of Energy, Elastic and Inelastic Collisions between particles, Angular Momentum of a Particle and System of Particles, Moment

of Inertia, radius of gyration, Calculation of Moment of Inertia for Rectangular, Cylindrical and Spherical Bodies, Kinetic Energy of Rotation, Law of gravitation. Inertial and Gravitational Mass, Motion of a Particle under Central Force Field, Two Body Problem and its Reduction to One Body Problem and its Solution. The Energy Equation and Energy Diagram. Kepler's Laws (Ideas Only), Orbits of Artificial Satellites, Reference Frames, Inertial and noninertial frames, Galilean Invariance and Conservation Laws, Fictitious Forces, Centrifugal forces, Coriolis Force and its Applications, Michelson- Morley Experiment and its Outcome. Postulates of Special Theory of Relativity, Galilean Transformations, Lorentz Transformations, Length Contraction, Time Dilation, Variation of Mass with Velocity, Mass energy Equivalence, Bucherer's experiment, Doppler effect.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To study different types of energy and easily differentiate between conservative and nonconservative forces.

CO 2 To determine moment of inertia for some simple body geometries.

CO 3 To study the detailed knowledge of gravitational and central force motion.

CO 4 To explore the properties inertial and non-inertial frames and different types of forces and their applications.

CO 5 To develop the understanding of non-relativistic and relativistic mechanics for applications such as in GPS.

PYL104 MATHEMATICAL PHYSICS I

(3-1-0=4 Credits)

Vector Differentiation, Divergence and Curl of a Vector Field, Del and Laplacian Operators. Line, Surface and

Volume Integrals. Gauss' Divergence Theorem, Green's Theorem and Stokes Theorem, Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems, Double and Triple Integrals, Beta and Gamma Functions and Relation between them, Systematic and Random Errors, Expression of Integrals in terms of Gamma Functions, Fourier Series, Kronecker's Method for Computation of Fourier Coefficients. Even and Odd Functions. Orthogonality of Sine and Cosine Functions. Sine and Cosine Series. Differentiation and Integration of a Fourier series.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To study the vector differentiation, integration and different types of operators.

CO 2 To determine the divergence, curl and Laplacian in various types of coordinates system.

CO 3 To explore the properties of multiple integrals and their applications.

CO 4 To determine the different types of errors and their propagations.

CO 5 To study the detailed knowledge about Fouries series, sine and cosine function and their applications.

PYL105 ELECTRICITY AND MAGNETISM

(3-0-2=4 Credits)

AC Circuits :- Complex Reactance and Impedance. Series LCR Circuit andParallel LCR Circuit. Network theorems, Electric Field and Electric Potential: Dielectric Properties of Matter, Dielectric Constant. Parallel Plate Capacitor with a Dielectric. Polarization, Polarization Charges and Polarization Vector. Electric Susceptibility. Gauss's law in Dielectrics Magnetic Field

Magnetic Force between Current Elements, Magnetic Flux. Biot-Savart's Law, Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital law (Integral and Differential Forms): B due to (1) a Solenoid and (2) a Toroid. Properties of B. Curl and Divergence of B. Vector Potential. Gauss's law of magnetism (Integral and Differential Forms).Magnetization current. Relative Permeability of a Material. Magnetic Susceptibility. Relation between B, M and H. Stored Magnetic Energy in Matter. Magnetic Circuit. B-H Curve and Energy Loss in Hysteresis.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To provide the basic concepts electric and magnetic fields and to provide knowledge in the instruments

CO 2 To provide adequate knowledge about industrial applications of electricity and magnetism.

CO 3 To provide adequate knowledge about dielectric properties od matter and to provide adequate knowledge about Industrial application.

CO 4 To provide adequate knowledge about magnetic properties of matter.

PYL106 SOLID STATE PHYSICS

(3-0-2 = 4 Credits) 42 Lectures

Amorphous and Crystalline Materials. Crystal Lattice. Reciprocal Lattice. Types of Lattices. Types of Bonds. Crystal structure by Bragg's Law. Lattice Vibrations and Phonons. Acoustical and Optical Phonons spectrum. Einstein and Debye Theories of Specific Heat of Solids. Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia – and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Polarization. Electric Susceptibility. Local Electric Field at an Atom. Clausius-Mosotti Equation. Depolarization Field. Normal and Anomalous Dispersion. Complex Dielectric Constant. Elementary Band Theory of Solids. Bloch Theorem. Kronig-Penney Model. Effective Mass of Electron. Concept of Holes. Classification of Solids. Law of Mass Action. Direct and Indirect Band Gap Semiconductors. Hall Effect in Semiconductors (Qualitative Discussion Only). Superconductivity. Meissner effect. Type I and type II Superconductors, London's Equation Isotope effect. Ideas of BCS theory (No derivation): Experimental Evidence of Phonons Josephson Effect.

Course Outcomes (COs)

Student will have complete knowledge and understanding of structure of solids and their thermal, dielectric magnetic and electronic properties as mentioned in COs below. They can apply this learning in a large number of electronic, magnetic, dielectric devices such as electromagnets, magnetic cores, memories, electroacoustic transducers, piezoelectric devices, transistors, solar cells, LEDs, photodiodes, etc. which have their design and performance dependent on the properties of various solids.

CO 1 Crystal lattice, types of lattices and types of bonds in lattices, structure parameters and indices, X-ray diffraction for structure determination, etc.

CO 2 Lattice vibrations and phonons, phonon spectra and theory of specific heat of solids.

CO 3 Magnetic properties of solids including dia-, para and ferro-magnetism, Curie – Weiss Law, ferromagnetic domains, hysteresis etc.

CO 4 Dielectric properties of solids. Relation between polarizability and dielectric constant, dielectric dispersion, etc.

CO 5 Band theory of solids, Kronig-Penney relation, energy band diagrams, concept of effective mass and holes, classification into metals, semiconductors and insulators, Hall mobility, etc.

CO 6 Superconductivity, Meissner effect, Ideas of BCS theory, Josephson effect, etc.

PYL108 QUANTUM MECHANICS

(3-0-0 = 3 Credits) 42 Lectures

Introduction to Quantum Mechanics: Failures of classical mechanics, wave nature of particles, discreteness of energy levels, Postulates and Operators in Quantum Mechanics: The basic postulates of quantum mechanics, properties, physical significance and Born interpretation of wave functions ,operators, commutator algebra [x, px], [y, py], eigen values and eigen vectors of an operator, Ehrenfest theorem. Schrodinger Equation-I:Time dependent and independent Schrodinger equations. One dimensional problems. Schrodinger Equation-II: Schrodinger equation for two particles, Schrodinger equation in spherical coordinates with central potential, orbital angular momentum operators and their communication relations, eigen values and eigen functions of L2 and Lz, Schrodinger equation for hydrogen like atoms.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To explain the inadequacies of classical mechanics

CO 2 To explain the wave particle duality of particle

CO 3 To explain the basic postulates of quantum mechanics

CO 4 To apply the different operators used in quantum mechanics

CO 5 To apply time dependent and independent Schrodinger equation

CO6 To explain Schrodinger equation in a spherical potential

PHYSICS LAB EXPERIMENTS

1. To measure the resistance per unit length of the wire of bridge and to determine an unknown resistance by carey foster.

2. To measure the current flowing in a circuit by measuring the drop of potential across the known resistance in the circuit using a potentiometer (by measuring the resistance of potentiometer with Post office Box.
5. To determine the refractive of liquid by Newton rings using sodium light.
6. To determine the dispersive power of material using mercury lamp.
7. To determine wavelength of sodium light using Fresnel biprism.
8. To determine wavelength of Laser using diffraction grating.
9. To determine angular spread of He-Ne using diffraction grating.
10. To determine the specific rotation of sugar solution using Laurent's half shade device.
11. To verify Brewster law.
12. Determination of wavelength of various color using diffraction grating.

PYL 110 FUNDAMENTALS OF ELECTRONIC COMMUNICATION

(3-1-0=3 Credits) 28 Lectures

Introduction to Communication System, Modulation and Demodulation techniques, Antenna and Radio Wave Propagation, Radio receiver and Television, Telephone System

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 Acquired knowledge about basic analog and digital communication
CO 2 Knowledge about technology used in communication
CO 3 Capable of performing various antenna measurements
CO 4 Ability to identify characteristics of radio wave propagation
CO 5 To learn about basic telephone system

PYL201 ELECTROMAGNETIC THEORY

(3-0-2 = 4 Credits) 42 Lectures

Maxwell's Equahtions: Maxwellequations ,displacement current, vector and scalar potentials. Gauge Transformations, wave equations, Poynting theorem and Poynting vector,Electromagnetic energy density. Reflection and Refraction of Electromagnetic Waves: Reflection and Refraction of a Plane Wave at a Plane Interface between Dielectics, Waves in Conducting Media ,Skin Depth.Maxwell's Equations in Microscopic Media (Plasma). Polarization of Electromagnetic Waves:Description of Linear, Circular and Elliptical Polarization. Propagation of e.m. Waves in Anisotropic Media. Double Refraction.Polarization by Double Refraction.Nicol Prism.Ordinary and Extraordinary Refractive Indices. Phase Retardation Plates, Optical Rotation, Laurent's Half-Shade Polarimeter. Optical Fibres and Wave Guides:Numerical aperture, types of fibres (Concept and Definition Only).Planar Optical Wave Guides. Phase and Group Velocity of the Guided Waves. Field Energy and Power Transmission.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To write Maxwell's electromagnetic equations
CO 2 To explain the reflections and transmission of electromagnetic waves in different media.
CO 3 To explain the polarization of electromagnetic waves
CO 4 To explain the propagation of electromagnetic wave in optical fibre
CO 5 To explain the optical wave guide

PYL203 THERMAL PHYSICS

(3-0-2 = 4 Credits) 42 Lectures

Thermodynamics: Zeroth and First Law of Thermodynamics Work and Heat Energy. State Functions. First Law and Various Processes. Work Done during Isothermal and Adiabatic Processes.Compressibility and Expansion Coefficient. Atmosphere and Adiabatic Lapse Rate.Second Law of Thermodynamics :- Reversible and Irreversible Changes,Heat Engines. Carnot Cycle. Second Law of Thermodynamics,Carnot Theorem.

Applications of Second Law of Thermodynamics , Entropy : Change in Entropy. Entropy of a State.Clausius Theorem. Second Law of Thermodynamics in terms of Entropy. Entropy Changes in Reversible and Irreversible Processes. Third Law of Thermodynamics. Maxwell's Thermodynamic Relations:- Derivations of Maxwell's Relations and pplications of Maxwell's Relations. Kinetic Theory of Gases:-Distribution of Velocities, Doppler Broadening of Spectral Lines and Stern'sExperiment. Law ofEquipartition of Energy (No proof required). Specific Heats of Gases.Molecular Collisions, Transport Phenomenon in Ideal Gases.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To explain the different laws of thermodynamics

CO 2 To explain the Carnot's cycle and applications of second law of thermodynamics

CO 3 To explain entropy and phase transitions.

CO 4 To write Maxwell's thermodynamical relations and apply them to different physical phenomena

CO 5 To explain the kinetic theory of gases

PYL204 ATOMIC AND MOLECULAR PHYSICS

(3-1-2 = 5 Credits) 42 Lectures

Determination of e/m of the Electrons, Isotopes and Isobars. Mass spectrometry. X-rays Ionizing Power, Bragg's Law. X-rays-Spectra. Moseley Law. Orbital and spin quantization of electron angular momentum, associated magnetic moment, Larmor precession Theorem. Stern-Gerlach Experiment. Zeeman Effect (Normal and Anomalous). Paschen Black and Stark Effects (Qualitative Discussion only). Pauli's Exclusion Principle. Symmetric and Antisymmetric Wave Functions. Electron distribution in elements and Periodic table. Fine structure. Spectral Notations for Atomic States. Total Angular Momentum L-S and J-J couplings. Hund's Rule. Spectra of Hydrogen and Alkali Atoms (Na etc.). Rotational Energy and Vibrational Energy Levels, Selection Rules Determination of Inter-nuclear Distance. Raman Effect. Quantum Theory. Stoke's and Anti-Stoke's Lines. Complimentary Character of Raman and infrared Spectra. Lasers: Einstein's A and B coefficients. Metastable states. Optical Pumping and Population Inversion. Ruby Laser and He-NeLaser.

Course Outcomes (COs)

The learning gained as per the following COs will enable analyze XRD and XRF, infra-red and optical spectra, Raman spectra of materials These applications are crucial in analysis and synthesis of materials.

CO 1 e/m ratio of electrons, isotopes, isobars. Mass spectrometry, X-rays diffraction (XRD) and X-ray spectroscopy (XRF).

CO 2 orbital and spin quantization of electron angular momentum, associated magnetic moment, Larmor precession, various effects associated with electron magnetic moment in external magnetic and electric fields.

CO 3 Pauli-exclusion principle, Electron distribution in elements and Periodic table. Spectra of hydrogen and alkali atoms.

CO 4 Various degrees of freedom of molecular motion, associated energy levels and molecular spectra.

CO 5 Raman effect, theory, spectra and comparison with infrared spectra.

CO 6 Principle of laser, components of laser, characteristics and ruby, He-Ne lasers.

Physics LabExperiments

1. To determine the fill factor of photovoltaic cell.
2. To verify and design AND, OR, NOT and XOR gates using NAND gates.
3. To design a combinational logic system for a specified TruthTable.
4. To design a Seven-Segment Display driver.
5. Half Adder, Full Adder and 4-bit Binary Adder.
6. Half Subtractor, Full Subtractor, Adder- Subtractor using Full Adder I.C.
7. To build Flip-Flop Circuits using elementary gates (RS, Clocked RS, D-type, and JK Flip-Flop).
8. To build a 4-bit Counter using D-type/JK Flip- Flop.

9. To make a Shift Register from D-type/JK Flip- Flop. 4. Serial and Parallel shifting of data.
10. To covert Voltmeter to Ammeter and vice versa. (Electricity and Magnetism)

PYL205 STATISTICAL MECHANICS

(3-1-0 = 4 Credits) 42 Lectures

Kinetic theory of gases, ideal gas equation, Van der Waals equation, mean free path, transport phenomena, etc. Entropy and Probability. Maxwell- Boltzmann Distribution Law. Partition Functions. Thermodynamics of state variables and their derivatives. Planck's Law of Blackbody Radiation. Stefan-Boltzmann Law. Bose-Einstein Statistics. BE condensation, Saha's Ionization Formula. Fermi-Dirac Statistics and Distribution Law. Degenerate Fermi Gas. Specific Heat of Metals. White Dwarf Stars. Chandrasekhar Mass Limit.

Course Outcomes (COs)

This course gives an understanding of microscopic nature of thermal processes taking place in materials as per the following COs. On successful completion of the course, the students will be able to apply their learning to analyze solve practical and theoretical problems related matter radiation interaction, specific heat of materials, problems of diffusion and heat conduction, super-fluidity of helium, white dwarf, etc.

CO 1 kinetic theory of gases, ideal gas equation, Van der Waals equation, mean free path, transport phenomena, etc.

CO 2 Thermos-dynamic state properties of classical physical systems statistics of particle energy distribution in classical and quantum systems including M-B, B-E and F-D distributions.

CO 3 the laws of black-body radiation and understanding of quantum nature of electromagnetic radiations

CO 4 Bose-Einstein condensation its role in understanding of a number of physical phenomena including properties of liquid helium

CO 5 Fermi energy and degenerate Fermi gas and their role in understanding of a number of physical phenomena including properties of specific heat, helium III, white dwarf, etc.

PHYSICS LAB EXPERIMENTS

1. To determine Planck constant using photo electric cell.
2. To determine the velocity of light as a quotient of optical path travelled by a light pulse and the transit time.
3. To study the variation of magnetic field along the axis of a circular coil carrying current and extimate the radius of the coil.
4. To demonstrate dia, para, ferromagnetism in homogeneous magnetic field.
5. To determine the specific heat capacity of solid using copper, lead and glass.
6. To determined the Stefans Constant
7. To study the Hall effects
8. To plot I-V characteristics of CDS Photo register

PYL202 Mathematical Physics II (3-1-0=4 Credits) 42 Lectures

Differential Equations and its Classification, Linear Ordinary Differential Equations First and second order (with examples from vibrations, heat conduction, diffusion etc.), Solution of Non-homogeneous Equations by D Operator Method. Bernoulli and Euler Equations. Coupled Differential Equations, Euler's Equation and its Application to Simple Problems, Hamilton's Principle. Poisson Brackets and their Properties.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To study the basics of differential equation and their classifications.

CO 2 To solve linear differential equation for various problems.

CO 3 To explore the properties of second order differential equations.

CO 4 To determine the different types of equations and their applications.

CO 5 To study the detailed knowledge about Lagrange Multipliers and their applications.

PYL 206 NONLINEAR OPTICS (3-1-0)

Light matter interaction, Nonlinear perturbation theory and coupled mode equations, Anharmonic oscillator model, second and third order effects, phase-matching mechanisms, vibrational transitions in molecules and Raman- nonlinearity, Kerr nonlinearity.

Course Outcomes (COs)

After the successful completion of the course, the students will be able to;

CO 1 Understand the light matter interaction and origin of Nonlinear optics (NLO).

CO 2 Have indepth knowledge of optical processes of NLO,having the potential of industrial applications.

CO 3 Understand the scattering of light at high intensity.

CO 4 Know about intensity dependent refractive index and various types of nonlinearities for technological importance.

PYL207 NUCLEAR, PARTICLE AND ASTROPHYSICS

(3-1-0=4 Credits) 42 Lectures

Properties of Nuclues: General properties of the atomic nuclei, nuclear charge, elementary idea of nuclear fission and fusion. Qualitative discussion of the nature of nuclear forces.Radioactive Decay and Interaction of Nuclear Radiation with Matter
:Radioactive series decay, Qualitative discussion of alpha, beta and gamma-decays, Nuclear radiation detectors Particle Physics: Basic interactions and their mediating quanta, classification of particles, idea of resonances, conservation rules in fundamental interactions, determination of spin and parity of pions, strange particles, isospin and its conservation, quarks, their quantum numbers and quark model. Cosmic Rays and Astrophysics Primary cosmic rays, Production secondary cosmic rays, Structure of the sun, stellar energy source, p-p and C-N-O cycles and their temperature dependence, H-R diagram, white dwarf and Chandrasekhar mass limit, neutron star and pulsar, Schwarzschild radius and Black Holes.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To explain the different properties of atomic nuclei and nature of nuclear forces
CO 2 To explain radioactive decay and interaction of nuclear radiation with matter
CO 3 To classify particles and explain the conservation rule in fundamental interactions
CO 4 To explain the primary cosmic rays and production of secondary cosmic rays.
CO 5 To explain different astrophysical phenomena

PYL208

BioPhysics (3-1-0)

Advanced Nuclear Magnetic Resonance, Biomolecular structure determinations, Microscopy, Fluorescence,Tomography & 3D single-particle reconstruction, Analysis of structure using Electrostatics - potentials & pKs, Molecular Dynamics, Mass Spectrometry, Theory & instrumentation, Footprinting & dynamics

Course Outcomes (COs)

After successful completion of the course students will be able to

CO 1 Attain the understanding of magnetic resonance and its applications.
CO 2 Know the role of physics in biological materials.
CO 3 Analyze the structure of biomolecules and its applications in medical fields.
CO 4 Have understanding of interaction of radiation with biomaterial.

PYL309 LASERS

(3-1-0=4 Credits) '42 Lectures

Introduction to lasers :Black body radiation - Lifetime of excited state - Decay of excited states - Condition for

producing laser - Gain and gain saturation - Saturation intensity - Threshold condition - Requirements for obtaining population inversion Steady state and transient population processes. Gas lasers: He-Ne laser, Argon-ion, Nitrogen laser - Carbondioxide laser, Excimer laser - Chemical laser - X-ray laser - Free electron laser. Solid state, semiconductor and liquid lasers: Pumping mechanism, Ruby laser - Nd:YAG - Nd:Glass - Er doped laser – Ti-Sapphire laser - Intrinsic semiconductor laser - Doped semiconductor - Condition for laser action, Injection laser - Threshold current - Homojunction – Hetrojunction - Double hetrojunction lasers - Quantum well laser - Liquid lasers - Pulsed-CW dye laser - Threshold condition - Configuration - Tuning methods. Application of lasers.

Course Outcomes (COs)
Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed
CO 1 To provide the basic concepts Lasers and to provide working knowledge in the instruments
CO 2 To provide adequate knowledge about industrial applications of Lasers.
CO 3 To provide adequate knowledge about lasing condition and population inversion
CO 4 To provide adequate knowledge about tuning methods.

PYL301 DIGITAL ELECTRONICS

(3-1-2 = 5 Credits) 42 Lectures

Block Diagram of CRO. Electron Gun, Deflection System and Time Base, Applications of CRO, Integrated Circuits (Qualitative Treatment only) :- Active and Passive components. DiscreteCircuit Component. Wafer. Chip. Advantages and Drawbacks of ICs. Scale of integration :SSI, MSI, LSI and VLSI Classification of ICs. Fabrication of Components on Monolithic ICs. Examples of Linear and Digital ICs. Operational Amplifiers, Operational Amplifiers Timers and its Applications , Difference Between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. AND, OR and NOT Gates , NAND AND NOR Gates. Exclusive OR and Exclusive NOR Gates. Boolean algebra, De Morgan's Theorems, Simplification of Logic Circuit using Boolean Algebra,Fundamental Products, Minterms and Maxterms, Karnaugh Map, Data processing Memories (ROM), PROM, EPROM, Arithmetic Circuits , Sequential Circuits, Shift registers Counters, D/A and A/D conversion

Course Outcomes (COs)
Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed
CO 1 To understand CRO.
CO 2 To have in-depth knowledge of analog circuits.
CO 3 To have in-depth knowledge of digital circuits.
CO 4 To understand principle of operational amplifier and its use.

Physics LabExperiments

1. To determine the fill factor of photovoltaic cell.
2. To verify and design AND, OR, NOT and XOR gates using NAND gates.
3. To design a combinational logic system for a specified TruthTable.
4. To design a Seven-Segment Display driver.
5. Half Adder, Full Adder and 4-bit Binary Adder.
6. Half Subtractor, Full Subtractor, Adder Subtractor using Full Adder I.C.
7. To build Flip-Flop Circuits using elementary gates (RS, Clocked RS, D-type, and JK Flip-Flop).
8. To build a 4-bit Counter using D-type/JK Flip- Flop.
9. To make a Shift Register from D-type/JK Flip- Flop. 4. Serial and Parallel shifting of data.
10. To covert Voltmeter to Ammeter and vice versa. (Electricity and Magnetism)

PYL302 NUCLEAR AND PARTICLE PHYSICS

(3-1-0 = 4 Credits) 42 Lectures

Structure of nuclei, Radioactivity, Law of Radioactive Decay, Half-life, Radioactive Series, Binding Energy, Mass Formula., α-decay :- Range of α-particles, Geiger-Nuttal law and α-particle Spectra, β-decay :- Energy Spectra and Neutrino Hypothesis. γ-decay: - Origin of γ-rays, Nuclear Isomerism and Internal Conversion, Nuclear Reactions :- Types of Reactions and Conservation Laws. Concept of Compound and Direct Reaction, Attractive and

Repulsive Potential Barriers. Scattering Cross-section, Reaction Rate. Q- value of Reaction, Fission and Fusion, Nuclear Models:

- Liquid Drop Model, Mass formula, Shell Model, Accelerators :- Van de Graaff Generator, Linear Accelerator, Cyclotron, Betatron, and Light and Heavy Ion Synchro-Cyclotron. Idea of Large Hadron Collider, Ionization chamber, GM Counter, Scintillation Detectors, Elementary Particles, Classification of Elementary Particles, Baryons, Hyperons, Leptons, and Mesons, Supermultiplets of Mesons and Baryons, Conservation Laws and Symmetry, Different Types of Quarks and Quark Contents of Spin, Baryons, Photons, Gravitons, Gluons, Idea of Standard Model, Higg's Boson.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To study the depth knowledge of structure of nuclei i.e its mass, stability, binding energy etc.
CO 2 To distinguish between alpha, beta and gamma decay and study their energy spectra.
CO 3 To study the different types of nuclear reactions, nuclear models and their advantages.
CO 4 To identify the different types of acceralators, detectors and their industrial applications.
CO 5 To study the different types of particles and antiparticles and their classification.

PYL303 MICROPROCESSOR

(3-0-2 = 4 Credits) 28 Lectures

Hexadecimal Number System and Arithmetic. Computer organization. Input / Output Devices. Data Storage. Computer Memory. Memory Organization and Addressing. Memory Interfacing. Memory Map. Intel 8085 Microprocessor Architecture Main Features of 8085. Block Diagram. Components. Pin-out Diagram. Buses. Registers. ALU. Memory. Stack Memory. Interfacing Devices. Timing and Control Circuitry. Timing States. Instruction Cycle (Timing Diagram). Interrupts and Interrupt Control. Input / Output.

8085 Instructions:- Instructions. Machine Language. Assembly Language. Instruction Set and Format. Data Transfer, Arithmetic, Logical, Branching and Machine Control Operations. RIM and SIM. Addressing Modes : Register, Implied, Immediate, Direct and Indirect. Microprocessor Programming :- Algorithm and Flowcharts. Simple programming Exercises : Addition, Subtraction, Multiplication and Division - Both 8 and 16 bit etc.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 Identify the basic elements and functions of 8085 and 8086 microprocessors

CO 2 Explain the architecture and operation of 8085 and 8086 microprocessors

CO 3 Understand the instruction sets of 8085 and 8086 and identify timing sequence of different instructions

CO 4 Apply the programming techniques in designing simple assembly language programs for solving simple problems by using instruction sets of microprocessors

CO 5 Identify and explain the operations of peripherals and memories typically interfaced with microprocessors

CO 6 Review some advancements in latest technological trends through features of current and advanced microprocessors

PYL304 ELECTRONIC DEVICES

(3-1-0 = 4 Credits) 42 Lectures

Circuit Analysis, Wheatstone Bridge and its Applications to Wein Bridge and Anderson Bridge. Semiconductor Diodes Barrier Potential, Barrier Width and Current for Step Junction. pn junction and its characteristics, Static and Dynamic Resistance, Diode Equivalent Circuit, Ideal Diode., Load Line Analysis of Diodes.Load Line and Q-point. Rectifier Diode. Half- wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers , Zener Diode and Voltage Regulation Photo Diode, Tunnel Diode, LED , Varactor Diode. Bipolar Junction transistors Characteristics of CB, CE and CC Configurations. Current gains , Load Line Analysis Q- point. Amplifiers. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Resistance,Voltage and Power Gains. Class A, B, and C Amplifiers., Coupled Amplifiers , Feedback in Amplifiers, Sinusoidal, Hartley Oscillator. Colpitts Oscillator., Non-Sinusoidal Oscillators – Astable and Monostable Multivibrators. UJT : Its Chararacteristics and Equivalent Circuit, Relaxation Oscillator, JEFT : Its Characteristics and Equivalent Circuit. Advantagesof JFET. MOSFET Modulation and DemodulationPYL305 Experimental and analytical techniques (3- 0- 2=4 Credits)

Crystalline Semiconductors: Growth, Diffusion, ion implantation, oxidation, microlithography, plasma etching,

thin film deposition, Introduction to compound semiconductors.

UV-VIS/IR spectrophotometer, Raman spectroscopy, X-ray diffraction, LCR meter, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning Tunneling Microscopy (STM), Scanning Force Microscopy (SFM), Atomic Force Microscopy (AFM), Z-Scan.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To understand the basics of bridges
CO 2 To have in depth knowledge of diodes
CO 3 To have basic idea of amplifications
CO 4 To understand the oscillators

PYL306 THIN FILMS AND NANOMATERIALS

(3-0-2=4 Credits) 42 Lectures

Difficulties with classical physics, Planck's constant, Introduction to quantum mechanics-simple concepts, Phase velocity and group velocity, Schrodinger wave equations (time independent), Concept of stationary states, Particle in a one-dimensional box Basic understanding of Nanotechnology, Nanoscale Beyond Moore's Law, Quantum Confinement. Quantum Dot, Quantum Wire, Nanorods, metallic nanoparticles, graphene and graphene oxide, semiconductor quantum dots nanocrystals, Porous Silicon, Aerogels, Nanoshells, Nanofluids, Carbon Nanotubes, Fullerenes, Graphenes. Dangling Bonds, Physiochemical Properties, Linear and Nonlinear Optical Properties of Nanomaterials, Synthesis of nanomaterials, Characterization of nanomaterials: UV-VIS absorption spectrophotometer, LCR meter, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning Tunneling Microscopy (STM), Scanning Force Microscopy (SFM), Atomic Force Microscopy (AFM), Z-Scan. Applications of nanomaterials.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To understand the basics of nanomaterials by simple concepts of Quantum mechanics.
CO 2 To categories different types of nanomaterials and its applications.
CO 3 To gain good knowledge of properties of nanomaterials.
CO 4 To explore the different techniques for synthesis of nanomaterials.
CO 5 To have indepth knowledge of characterization techniques of various nanomaterials.

PYL307 FIBER OPTICS

(3-0-2=4 Credits) 42 Lectures

Optical fibers and their properties: Basic optical laws and definitions– Principles of light propagation through a fiber – Different types of fiber and their properties – Modes of propagation – Attenuation - Signal distortion in optical waveguides – Pulse broadening in graded index waveguides – Absorption losses – Scattering losses – Dispersion – Connectors & Splicers Fiber Optical sources and optical detector: Optical sources – LED structures – types of LED – planar – dome – surface emitting – Light source materials – Quantum efficiency and LED power – Modulation of an LED.Optical detectors – Principles of photo detection – PIN photodiode – Avalanche photodiode and its characteristics, Industrial applications of optical fibers: Fiber optic sensors – Fiber optic instrumentation system – Different types of modulators –Interferometric method of measurement of length – Moire fringes – Measurement of pressure –temperature – current – voltage – liquid level and strain, Holography & applications: Holography – Basic principles – Methods of holographic interferometry and applications –Holography for NDT – Medical application of lasers – Laser and tissue interaction – Laser instruments for surgery – Removal of tumors of vocal chords – Brain surgery – Plastic surgery –Gynecology – Oncology

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To provide the basic concepts of optical fibers and to provide knowledge about optical sources and optical detectors
CO 2 To provide adequate knowledge about industrial applications of optical fibers.
CO 3 To provide adequate knowledge about Laser fundamentals and to provide adequate knowledge about Industrial application of lasers.
CO 4 To provide adequate knowledge about holography & Medical applications of Lasers.

PYL308 OPTICAL COMMUNICATION

(3-0-2=4 Credits) 42 Lectures

Introduction to optical communications, ray theory, geometrical optics approach, wave theory approach, types of fiber, modes in step and graded index fiber, losses in fiber-linear and non-linear losses, Solutions, optical sources- and detectors with their working principle and characteristics, various receiver configuration-direct detection, homodyne, hetrodyne receivers, noise sources in optical communication, optical fiber link design, optical components: optical switches, SOA, EDFA, mux/demux, couplers, introduction to optical space communication, fiber in local loop.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To provide the basic concepts of optical fibers and to provide knowledge about optical sources and optical detectors

CO 2 To provide adequate knowledge about industrial applications of optical fibers.

CO 3 To provide adequate knowledge about Laser fundamentals and to provide adequate knowledge about Industrial application of lasers.

CO 4 To provide adequate knowledge about holography & Medical applications of Lasers.

ABILITY ENHANCEMENT COURSES FOR UG

CHL100 ENVIRONMENTAL STUDIES 3-0-0 (3)

Definition, scope and importance, Need for Public awareness, Renewable and non-renewable resources: Natural resources and associated problems, Forest resources: Use and overexploitation: deforestation, case studies, Timber exploitation, mining, dams and their effects and forests tribal people, Water resources: Use and overutilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems, Ecosystem, Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Biodiversity and its conservations, Role of an individual in prevention of pollution, Pollution case studies, Social issues and the Environment, Human population and the Environment, Field Work.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 Application of knowledge gained to generate awareness for environmental protection so as to sensitize the student community towards environmental management and becoming Green Citizens and to apply the knowledge gained in sustaining various resources by using green technologies.

CO 2 To apply the concepts learnt in maintaining balance in natural ecosystems and it covers all aspects of life and contributes in constructive decision-making keeping environment in view.

CO 3 Development of understanding of pollution and to develop an understanding of Environmental management to enable them in becoming green engineers and green managers. To become green citizens and contribute in the sustainable development of the society, country and the world.

CO 4 To apply the concepts learnt in earning resources for their organizations by using green technologies.

CO 5 It encapsulates sound theoretical base of all the environmental aspects coupled with practical and projects.

CHL150 ENGINEERING CHEMISTRY

(2-0-2 = 3 Credits) 28 Lectures

Fundamental of thermodynamic, Derivation of Entropy, Gibbs Helmholtz and ClausiusClapeyron Equation. Fuel and Combustion, Catalysis, Hardness and its determination by EDTA method, alkalinity of water, Softening and desalination of water. Chemistry of Engineering Material(Cement, Polymers, Alloys and Composites), Properties

and classification of lubricants, Electrochemical corrosion, factor effecting and prevention methods of corrosion. Beer Lambart law, Principal, Instrumentation and application of UV spectroscopy, IR, TGA, DTA. Conductometric titration

Chemistry lab

1. Determination of heat capacity of calorimeter for different volume.
2. To determine moisture, volatile matter & ash content of a given sample of coal.
3. Determination of Calcium and Magnesium hardness of water sample by EDTA method.
4. To determine the alkalinity of a given water sample by volumetric method.
5. To prepare Phenol – Formaldehyde (PF) and Urea – Formaldehyde (UF) resins.
6. Estimation of Calcium in Portland Cement.
7. To study the effect of temperature on viscosity of a given oil by Redwood Viscometer)
8. To find out the saponification value of coconut oil.
9. Study of corrosion of metals in medium of different pH solution using pH meter.
10. To find out the strength of the given hydrochloric acid solution by titrating it against Sodium Hydroxide solution using pH meter.
11. To find out the strength of the given hydrochloric acid solution by titrating it against Sodium Hydroxide solution conductometrically.
12. To determine the concentration of KMnO4 solution using UV – Spectrophotometer.
13. To determine the amount of sodium and potassium in a given sample of water by flame photometer .

To draw the chemical structures of various compound using software ACD/ chemSketch .

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 Identify and formulate elementary level engineering problems related to thermodynamics and energy transformation in a conceptual form as well as in terms of mathematical models.

CO 2 Ability to characterize the fuels and understand the combustion mechanisms of various fuels

CO 3 To understand the technologies for wastewater treatment to make it suitable for human consumption and industrial application.

CO 4 To understand practices for the prevention and remediation of corrosion.

To analyze properties of lubricants utilized for application purpose.

CO 5 Explain various types of engineering material and application in various fields

CO 6 Understand the methodology for quantitative and qualitative analysis of material

CHL350 POLYMER COMPOSITE

(3-0-2=4Credits) 28 Lectures

Fundament of polymer materials, mechanism of polymerization, classification of composites, natural fibres (jute, cellulose), carbon fibres, resins, characterization methods of polymer and composites such as (TGA, DTA, IR, NMR, UV-visible), Mechanical properties of polymer and composites (tensile strength, modulus, shear strength etc). Application of Polymer Composite in various industries; Textile, Automobile, Aerospace, Building and Construction. Project work and case studies.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 Students would be aware of the basic concepts of polymers, polymerization process and relate examples with daily life applications.

CO 2 Students would be aware of the basic concepts of composites and process to form polymer composites using different fibers. This knowledge would be useful for industry and technology perspectives..

CO 3 Student would understand the various properties of polymer and composites and the analytical techniques which can use for the identification of composites materials.

CO 4 Students would be able to correlate the application of polymer technology to industries.

Department of Management

SML150 LEADERSHIP

(2-1-0= 3 Credits)

This course places self-awareness at the core of effective leadership. The students will be exposed

to personality assessments including the Enneagram, Strengths Finder and Multiple Intelligences Test to gain a deep understanding of their strengths and values. Topics include:Exploring, Identifying and Articulating Core Personal Values (Value Cards); Stages of Moral Development (Kohlberg's Experiment); Principled Leadership (Instilling Values in Others); Understanding Differences in Personality

(Enneagram Test); Multiple Intelligences Test (Howard Gardner); Trust Equations; and Attributes

of Leadership. The students will identify their intentions as leaders, learn strategies to improve

personal resilience and gain a deeper understanding of their leadership style. Interactive exercises, designed to allow students to experience leadership while studying it, help build a renewed sense of self as leader. The focus of the course is to move the individual from responding to the situation to being responsible for it. The students will learn to build their own motivation, confidence, skills, and commitment.

SML 300 ENTREPRENEURSHIP

(2-1-0 = 3 Credits)

This course aims to provide students with an understanding of the nature of enterprise and entrepreneurship and introduces the role of the entrepreneur, innovation and technology in the entrepreneurial process. It is not about small business or life style businesses but instead the development of growth oriented businesses -whether for-profit or not-for-profit. Entrepreneurship is both a way of thinking and of

doing. It involves "building something from nothing" and successful entrepreneurs know how to manage and mitigate uncertainty and risk. The course content is relevant to those individuals thinking about starting a business or who are already in business - large or small, those who are interested in commercializing their own innovations or of others, and those who advise entrepreneurs or engage in policy making in the

entrepreneurship area. The course provides step by step process of writing a business plan for the operation of a successful small business. The content of the course will include all aspects of start-up of a small business, sales, finance, personnel, marketing, budgets, insurances, customer target and possibly a different alternative to business either start up or purchase of small business.

CENTER FOR LANGUAGE LEARNING

CLL101 EFFECTIVE COMMUNICATION- I

(1-0-2= 2 Credits)

Vocabulary-1, Word building and enriching vocabulary Essentials of Grammar-1 Errors pertaining to Nouns, Pronouns, Verbs, Adverbs and Adjectives Writing Skills-1 Business Correspondence, Reading Skills-1 Theme detection, Literal comprehension Speaking Skills-1: Introducing oneself mini presentation, collaborative task, Listening Skills-1: Listening specific information, theme detection, gap filling.

CLL102 EFFECTIVE COMMUNICATION- II

(1-0-2= 2 Credits)

Vocabulary- 2 Technical vocabulary, foreign expressions. Essentials of Grammar- 2 Errors pertaining to Articles, Prepositions, Non-finites and conjunctions.Writing Skills-2 Resume Writing, Reports and Proposals. Reading Skills-2 Analytical reading,

Reading for cohesion and proof reading Speaking Skills-2 Group Discussion, Role playing activities, Public speaking, Simulated conversation, Facing Interview, Presentation skills, Business etiquette. Listening Skills-2 Listening short pieces for gist and analytical comprehension.

CLL120 HUMAN VALUES AND PROFESSIONAL ETHICS

(2-0-0= 2 Credits)

Human values – Morals, Indian views on Education, Understanding harmony in self, family, society and the existence; Self-exploration, Introduction to ethics, Ethical and Servant Leadership, Corporate Social Responsibility, Corporate governance – need and importance.

SCHEME OF B.Sc. (HONS) PHYSICS 2017-20

Sem	Course 1	Course 2	Course 3	Course 4	Course 5	Course 6	Lab		Contact hours	Credits
I	Waves &Oscillations PYL 101 (3-0-0)3	Maths-I ASL 101 (3-0-2) 4	Applied Mechanics PYL 103 (3-0-0)3	Electricity and Magnetism PYL 105 (3-0-0)3	Effective Communication-I CLL 101 (1-0-2) 2	Engg. Chemistry ASL 130 (2-0-2)3	Physics Lab1 (0-0-4)2	GPA 1	25	21
II	Optics PYL 102 (3-0-0)3	Mathematical Physics I PYL 104 (3-1-0)4	Solid State Physics PYL 106 (3-0-0) 3	Quantum Mechanics PYL 108 (3-0-0)3	Effective Communication-II CLL 102 (1-0-2)2	Fundamentals of Electronic Communication PYL110 (3-0-0) 3	Physics Lab2 (0-0-4)2	GPA 1	23	21
III	Electromagnetic Theory PYL 201 (3-0-0) 3	Thermal Physics PYL203 (3-0-0) 3	Statistical Mechanics PYL 205 (3-0-0) 3	Prog . Elec. I Lasers/ Nuclear, Particle and Astro physics (3-1-0)4	EVS ASL 140 (3-0-0) 3	Open Elective I (2-0-2) 3	Physics Lab3 (0-0-4)2	GPA 1	24	22
IV	Mathematical Physics II PYL202 (3-1-0) 4	Atomic and Molecular Physics PYL204 (3-1-0) 4	Polymer Composites ASL 310 (2-0-2)3	Prog .Elec. II Non Linear Optics/Biophysics (3-0-0)3	Open Elective II (2-0-2)3	----	Physics Lab4 (0-0-4)2	GPA 1	23	20
V	Numerical Analysis MAL310 (3-0-2) 4	Digital Electronics PYL 301 (3-1-0) 4	Microprocessor PYL303 (2-0-2)3	Prog .Elec.III Experimental and analytical Techniques/Fiber Optics (3-0-0)3	Open Elective III (2-0-2)3	----	Physics Lab5 (0-0-4)2	GPA 1	24	20
VI	Nuclear and Particle Physics PYL 302 (3-1-0)4	Electronic Devices PYL 304 (3-1-0)4	Prog . Elec. IV Optical Communication/Thin films and Nanomaterials (3-0-0)3	Open Elective IV (2-0-2)3	Project (0-0-6)3			GPA 1	21	18
Total Credits									140	122

The overall credits structure of BSc (Hons) Physics

Credits Structure	
Category	Credits
Program Core (PC)	84
Program Electives (PE)	13
Open Electives (OE)	12
Ability Enhancement Courses (AEC)	13
TOTAL	122

A. Program Core (PC)

			L-T/P	C
1	PYL 101	Waves and Oscillations	3-0-0	3
2	ASL 101	Maths-1	3-0-2	4
3	PYL103	Applied Mechanics	3-0-0	3
4	ASL 130	Engineering Chemistry	2-0-2	3
5	PYL105	Electricity and Magnetism	3-0-0	3
6		Physics Lab1	0-0-4	2
7	PYL102	Optics	3-0-0	3
8	PYL104	Mathematical Physics I	3-1-0	4
9	PYL106	Solid State Physics	3-0-0	3
10	PYL108	Quantum Mechanics	3-0-0	3
11	PYL110	Fundamentals of Electronic Communications	3-0-0	3
12		Physics Lab2	0-0-4	2
13	PYL201	Electromagnetic Theory	3-0-0	3
14	PYL203	Thermal Physics	3-0-0	3
15	PYL205	Statistical Mechanics	3-0-0	3
16		Physics Lab3	0-0-4	2
17	PYL202	Mathematical Physics II	3-1-0	4
18	PYL204	Atomic and Molecular Physics	3-1-0	4
19	ASL310	Polymer Composites	2-0-2	3
20		Physics Lab4	0-0-4	2
21	MAL310	Numerical Analysis	3-0-2	4
22	PYL301	Digital Electronics	3-1-0	4
23	PYL303	Microprocessor	2-0-2	3
24		Physics Lab5	0-0-4	2
25	PYL302	Nuclear and Particle Physics	3-1-0	4
27	PYL304	Electronic Devices	3-1-0	4
28		Project	0-0-6	3
		Total Credits		**84**

B.Program Electives (PE)

		L-T/P	C
PE-I			
PYL205	Lasers	3-1-0	4
PYL207	Nuclear, Particle and Astrophysics	3-1-0	4
PE-II			
PYL206	Non Linear Optics	3-0-0	3
PYL208	BioPhysics	3-0-0	3
PE-III			
PYL305	Experimental and Analytical Techniques	3-0-0	3
PYL307	Fibre Optics	3-0-0	3
PE-IV			
PYL306	Thin films and Nanomaterials	3-0-0	3
PYL308	Optical Communication	3-0-0	3

C. Ability Enhancement Courses (AEC) **L-T/P C**

CLL101	Effective Communication – I	1-0-2	2
CLL102	Effective Communication – II	1-0-2	2
ASL140	Environmental Studies	3-0-0	3
	GPA		6
	Total Credits		**13**

Short Syllabus for B.Sc. (H) Physics Courses (w. e. f. 2017-2020)

PYL101 Waves and Oscillations (3-0-0=3 Credits) 42 Lectures

SHM, Simple Harmonic Oscillations. Differential Equation of SHM and its Solution, Free Oscillations of Systems with One Degree of Freedom, Superposition of Two Collinear Harmonic Oscillations, Superposition of Two Perpendicular Harmonic System with Two Degrees of Freedom : Coupled Oscillators Free Oscillations. Damped , Forced Oscillations : Transient and Steady States, Resonance, Sharpness of Resonance, Power Dissipation and Quality Factor. Helmholtz Resonator.

Wave Motion :- Plane and Spherical Waves. Longitudinal and Transverse Waves.

Wave Equation. Particle and Wave Velocities. Velocity of Waves :- Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Superposition of Two Harmonic Waves :- Standing (Stationary) Waves in a String : Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

To understand the basics of oscillations like simple harmonic oscillation.

To have indepth knowledge of superposition of oscillations.

To have basic idea of concept of wave.

To understand the concept of superposition of waves.

PYL104 Mathematical Physics I (3-1-0=4 Credits) 42 Lectures

Vector Differentiation, Divergence and Curl of a Vector Field, Del and Laplacian Operators. Line, Surface and Volume Integrals. Gauss' Divergence Theorem, Green's Theorem and Stokes Theorem, Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems, Double and Triple Integrals, Beta and Gamma Functions and Relation between them, Systematic and Random Errors, Expression of Integrals in terms of Gamma Functions, Fourier Series, Kronecker's Method for Computation of Fourier Coefficients. Even and Odd Functions. Orthogonality of Sine and Cosine Functions. Sine and Cosine Series. Differentiation and Integration of a Fourier series.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To study the vector differentiation, integration and different types of operators.

CO 2 To determine the divergence, curl and Laplacian in various types of coordinates system.

CO 3 To explore the properties of multiple integrals and their applications.

CO 4 To determine the different types of errors and their propagations.

CO 5 To study the detailed knowledge about Fouries series, sine and cosine function and their applications.

PYL 103Applied Mechanics (3-1-0 = 3 Credits) 42 Lectures

Dynamics of a System of Particles, Centre of Mass, Conservation of Momentum, Work and Energy Theorem, Conservative and Non-Conservative Forces, Work done by Non-conservative Forces, Law of Conservation of Energy, Elastic and Inelastic Collisions between particles, Angular Momentum of a Particle and System of Particles, Moment of Inertia, radius of gyration, Calculation of Moment of Inertia for Rectangular, Cylindrical and Spherical Bodies, Kinetic Energy of Rotation, Law of gravitation. Inertial and Gravitational Mass, Motion of a Particle under Central Force Field, Two Body Problem and its Reduction to One Body Problem and its Solution. The Energy Equation and Energy Diagram. Kepler's Laws (Ideas Only), Orbits of Artificial Satellites, Reference Frames, Inertial and noninertial frames, Galilean Invariance and Conservation Laws, Fictitious Forces, Centrifugal forces, Coriolis Force and its Applications, Michelson-Morley Experiment and its Outcome. Postulates of Special Theory of Relativity, Galilean Transformations, Lorentz Transformations, Length Contraction, Time Dilation, Variation of Mass with Velocity, Mass energy Equivalence, Bucherer's experiment, Doppler effect.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To study different types of energy and easily differentiate between conservative and nonconservative forces.

CO 2 To determine moment of inertia for some simple body geometries.

CO 3 To study the detailed knowledge of gravitational and central force motion.

CO 4 To explore the properties inertial and non-inertial frames and different types of forces and their applications.

CO 5 To develop the understanding of non-relativistic and relativistic mechanics for applications such as in GPS.

PYL 105 Electricity and Magnetism (3-0-2=4 Credits) 42 Lectures

AC Circuits :- Complex Reactance and Impedance. Series LCR Circuit andParallel LCR Circuit. Network theorems, Electric Field and Electric Potential: Dielectric Properties of Matter, Dielectric Constant. Parallel Plate Capacitor with a Dielectric. Polarization, Polarization Charges and Polarization Vector. Electric Susceptibility. Gauss's law in Dielectrics

Magnetic Field B. Magnetic Force between Current Elements, Magnetic Flux. Biot-Savart's Law, Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital law (Integral and Differential Forms): B due to (1) a Solenoid and (2) a Toroid. Properties of B. Curl and Divergence of B. Vector Potential. Gauss's law of magnetism (Integral and Differential Forms).Magnetization current. Relative Permeability of a Material. Magnetic Susceptibility. Relation between B, M and H. Stored Magnetic Energy in Matter. Magnetic Circuit. B-H Curve and Energy Loss in Hysteresis

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To provide the basic concepts electric and magnetic fields and to provide knowledge in the instruments

CO 2 To provide adequate knowledge about industrial applications of electricity and magnetism.

CO 3 To provide adequate knowledge about dielectric properties od matter and to provide adequate knowledge about Industrial application.

CO 4 To provide adequate knowledge about magnetic properties of matter.

ASL 130 Engineering Chemistry (2-0-2 = 3 Credits) 28 Lectures

Fundamental of thermodynamic, Derivation of Entropy, Gibbs Helmholtz and ClausiusClapeyron Equation. Fuel and Combustion, Catalysis, Hardness and its determination by EDTA method, alkalinity of water, Softening and desalination of water. Chemistry of Engineering Material(Cement, Polymers, Alloys and Composites), Properties and classification of lubricants, Electrochemical corrosion, factor effecting and prevention methods of corrosion. Beer Lambart law, Principal, Instrumentation and application of UV spectroscopy, IR, TGA, DTA. Conductometric titration

Chemistry lab

15. Determination of heat capacity of calorimeter for different volume.
16. To determine moisture, volatile matter & ash content of a given sample of coal.
17. Determination of Calcium and Magnesium hardness of water sample by EDTA method.
18. To determine the alkalinity of a given water sample by volumetric method.
19. To prepare Phenol – Formaldehyde (PF) and Urea – Formaldehyde (UF) resins.
20. Estimation of Calcium in Portland Cement.
21. To study the effect of temperature on viscosity of a given oil by Redwood Viscometer)
22. To find out the saponification value of coconut oil.
23. Study of corrosion of metals in medium of different pH solution using pH meter.
24. To find out the strength of the given hydrochloric acid solution by titrating it against Sodium Hydroxide solution using pH meter.
25. To find out the strength of the given hydrochloric acid solution by titrating it against Sodium Hydroxide solution conductometrically.
26. To determine the concentration of $KMnO_4$ solution using UV – Spectrophotometer.
27. To determine the amount of sodium and potassium in a given sample of water by flame photometer .
28. To draw the chemical structures of various compound using software ACD/ chemSketch .

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 Identify and formulate elementary level engineering problems related to thermodynamics and energy transformation in a conceptual form as well as in terms of mathematical models.

CO 2 Ability to characterize the fuels and understand the combustion mechanisms of various fuels

CO 3 To understand the technologies for wastewater treatment to make it suitable for human consumption and industrial application.

CO 4 To understand practices for the prevention and remediation of corrosion.

To analyze properties of lubricants utilized for application purpose.

CO 5 Explain various types of engineering material and application in various fields

CO 6 Understand the methodology for quantitative and qualitative analysis of material

Physics Lab Experiments

5. To measure the resistance per unit length of the wire of bridge and to determine an unknown resistance by carey foster.
6. To measure the current flowing in a circuit by measuring the drop of potential across the known resistance in the circuit using a potentiometer (by measuring the resistance of potentiometer with Post office Box.
7. To determine the refractive of liquid by Newton rings using sodium light.
8. To determine the dispersive power of material using mercury lamp.
9. To determine wavelength of sodium light using Fresnel biprism.
10. To determine wavelength of Laser using diffraction grating.
11. To determine angular spread of He-Ne using diffraction grating.
12. To determine the specific rotation of sugar solution using Laurent's half shade device.
13. To verify Brewster law.
14. Determination of wavelength of various color using diffraction grating.

PYL 102 Optics (3-0-2 = 4 Credits) 42 Lectures

Fermat's Principle of Least Time or Extremum Path. Lenses, Lagrange and Helmholtz Laws of Magnification, Graphical Construction of Image using Cardinal Points. Thick Lens, Huygens Principle of Secondary Wavelets. Coherence, Interference: Division of Amplitude and Division of Wavefront, Interference in Thin Films, Fringes of Equal Inclination (Haidinger Fringes) and Fringes of Equal Thickness (Fizeau Fringes). Newton's Rings, Michelson's Interferometer,Fresnel and Fraunhoffer diffraction, Zone plate. Fraunhoffer Diffraction due to (1) a Single Slit (2) a Plane Transmission Grating. Rayleigh's criterion of resolution. Resolving Power and Dispersive Power of a Plane Diffraction Grating. Principle of Holography. Recording and Reconstruction Method. Theory of Holography as Interference between two Plane Waves. Polarization by refraction and reflection, Double refraction, Nicol prism, Quarter and half wave plates, Laurent's half shade polarimeter, Applications of polarization in chemical industry

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To understand the basics of optics.

CO 2 To have indepth knowledge of interference and its applications in research and industries.

CO 3 To have basic and advance idea of different types of diffraction, resolving and dispersive power of grating and its applications.

CO 4 To understand the concept of holography being widely used in security and decoration which is useful for the mankind?

CO 5 To have understanding of polarization and its applications in industries.

PYL 106 Solid State Physics (3-0-2 = 4 Credits) 42 Lectures

Amorphous and Crystalline Materials. Crystal Lattice. Reciprocal Lattice. Types of Lattices. Types of Bonds. Crystal structure by Bragg's Law. Lattice Vibrations and Phonons. Acoustical and Optical Phonons spectrum. Einstein and Debye Theories of Specific Heat of Solids. Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia – and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Polarization. Electric Susceptibility. Local Electric Field at an Atom. Clausius-Mosotti Equation. Depolarization Field. Normal and Anomalous Dispersion. Complex Dielectric Constant. Elementary Band Theory of Solids. Bloch Theorem. Kronig-Penney Model. Effective Mass of Electron. Concept of Holes. Classification of Solids. Law of Mass Action. Direct and Indirect Band Gap Semiconductors. Hall Effect in Semiconductors (Qualitative Discussion Only). Superconductivity. Meissner effect. Type I and type II Superconductors, London's Equation Isotope effect. Ideas of BCS theory (No derivation): Experimental Evidence of Phonons Josephson Effect.

Course Outcomes (COs)

Student will have complete knowledge and understanding of structure of solids and their thermal, dielectric magnetic and electronic properties as mentioned in COs below. They can apply this learning in a large number of electronic, magnetic, dielectric devices such as electromagnets, magnetic cores, memories, electroacoustic transducers, piezoelectric devices, transistors, solar cells, LEDs, photodiodes, etc. which have their design and performance dependent on the properties of various solids.

CO 1 Crystal lattice, types of lattices and types of bonds in lattices, structure parameters and indices, X-ray diffraction for structure determination, etc.

CO 2 Lattice vibrations and phonons, phonon spectra and theory of specific heat of solids.

CO 3 Magnetic properties of solids including dia-, para and ferro-magnetism, Curie – Weiss Law, ferromagnetic domains, hysteresis etc.

CO 4 Dielectric properties of solids. Relation between polarizability and dielectric constant, dielectric dispersion, etc.

CO 5 Band theory of solids, Kronig-Penney relation, energy band diagrams, concept of effective mass and holes, classification into metals, semiconductors and insulators, Hall mobility, etc.

CO 6 Superconductivity, Meissner effect, Ideas of BCS theory, Josephson effect, etc.

PYL 108 Quantum Mechanics (3-0-0 = 3 Credits) 42 Lectures

Introduction to Quantum Mechanics: Failures of classical mechanics, wave nature of particles, discreteness of energy levels, Postulates and Operators in Quantum Mechanics: The basic postulates of quantum mechanics, propeSrties, physical significance and Born interpretation of wave functions ,operators, commutator algebra [x, px], [y, py], eigen values and eigen vectors of an operator, Ehrenfest theorem. Schrodinger Equation-I:Time dependent and independent Schrodinger equations. One dimensional problems. Schrodinger Equation-II: Schrodinger equation for two particles, Schrodinger equation in spherical coordinates with central potential, orbital angular momentum

operators and their communication relations, eigen values and eigen functions of L2 and Lz, Schrodinger equation for hydrogen like atoms.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To explain the inadequacies of classical mechanics

CO 2 To explain the wave particle duality of particle

CO 3 To explain the basic postulates of quantum mechanics

CO 4 To apply the different operators used in quantum mechanics

CO 5 To apply time dependent and independent Schrodinger equation

CO6 To explain Schrodinger equation in a spherical potential

Physics Lab Experiments

1.To measure the resistance per unit length of the wire of bridge and to determine an unknown resistance by carey foster.

2.To measure the current flowing in a circuit by measuring the drop of potential across the known resistance in the circuit using a potentiometer (by measuring the resistance of potentiometer with Post office Box.

1. To determine the refractive of liquid by Newton rings using sodium light.
2. To determine the dispersive power of material using mercury lamp.
3. To determine wavelength of sodium light using Fresnel biprism.
4. To determine wavelength of Laser using diffraction grating.
5. To determine angular spread of He-Ne using diffraction grating.
6. To determine the specific rotation of sugar solution using Laurent's half shade device.
7. To verify Brewster law.
8. Determination of wavelength of various color using diffraction grating.

PYL 201 Electromagnetic Theory (3-0-2 = 4 Credits) 42 Lectures

Maxwell's Equations:Maxwell equations,displacement current,vector and scalar potentials. Gauge Transformations,wave equations, Poynting theorem and Poynting vector,Electromagnetic energy density. Reflection and Refraction of Electromagnetic Waves: Reflection and Refraction of a Plane Wave at a Plane Interface between Dielectics, Waves in Conducting Media ,Skin Depth.Maxwell's Equations in Microscopic Media (Plasma). Polarization of Electromagnetic Waves:Description of Linear, Circular and Elliptical Polarization. Propagation of e.m. Waves in Anisotropic Media. Double Refraction.Polarization by Double Refraction.Nicol Prism.Ordinary and Extraordinary Refractive Indices. Phase Retardation Plates, Optical Rotation, Laurent's Half-Shade Polarimeter.Optical Fibres and Wave Guides:Numerical aperture, types of fibres (Concept and Definition Only).Planar Optical Wave Guides. Phase and Group Velocity of the Guided Waves. Field Energy and Power Transmission.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To write Maxwell's electromagnetic equations

CO 2 To explain the reflections and transmission of electromagnetic waves in different media.

CO 3 To explain the polarization of electromagnetic waves

CO 4 To explain the propagation of electromagnetic wave in optical fibre

CO 5 To explain the optical wave guide

PYL203 Thermal Physics (3-0-2 = 4 Credits) 42 Lectures

Thermodynamics: Zeroth and First Law of Thermodynamics Work and Heat Energy. State Functions. First Law and Various Processes. Work Done during Isothermal and Adiabatic Processes.Compressibility and Expansion Coefficient. Atmosphere and Adiabatic Lapse Rate.Second Law of Thermodynamics :- Reversible and Irreversible Changes,Heat Engines. Carnot Cycle. Second Law of Thermodynamics,Carnot Theorem. Applications of Second Law of Thermodynamics , Entropy : Change in Entropy. Entropy of a State.Clausius Theorem. Second Law of Thermodynamics in terms of Entropy. Entropy Changes in Reversible and Irreversible Processes. Third Law of Thermodynamics. Maxwell's Thermodynamic Relations:- Derivations of Maxwell's Relations and pplications of Maxwell's Relations. Kinetic Theory of Gases:-Distribution of Velocities, Doppler Broadening of Spectral Lines and Stern'sExperiment. Law ofEquipartition of Energy (No proof required). Specific Heats of Gases.Molecular Collisions, Transport Phenomenon in Ideal Gases.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To explain the different laws of thermodynamics

CO 2 To explain the Carnot's cycle and applications of second law of thermodynamics

CO 3 To explain entropy and phase transitions.

CO 4 To write Maxwell's thermodynamical relations and apply them to different physical phenomena

CO 5 To explain the kinetic theory of gases

PYL 205 Statistical Mechanics (3-1-0 = 4 Credits) 42 Lectures

Kinetic theory of gases, ideal gas equation, Van der Waals equation, mean free path, transport phenomena, etc. Entropy and Probability. Maxwell-Boltzmann Distribution Law. Partition Functions. Thermodynamics of state variables and their derivatives. Planck's Law of Blackbody Radiation. Stefan-Boltzmann Law. Bose-Einstein Statistics. BE condensation, Saha's Ionization Formula. Fermi-Dirac Statistics and Distribution Law. Degenerate Fermi Gas. Specific Heat of Metals. White Dwarf Stars. Chandrasekhar Mass Limit.

Course Outcomes (COs)

This course gives an understanding of microscopic nature of thermal processes taking place in materials as per the following COs. On successful completion of the course, the students will be able to apply their learning to analyze

solve practical and theoretical problems related matter radiation interaction, specific heat of materials, problems of diffusion and heat conduction, super-fluidity of helium, white dwarf, etc.

CO 1 kinetic theory of gases, ideal gas equation, Van der Waals equation, mean free path, transport phenomena, etc.

CO 2 Thermos-dynamic state properties of classical physical systems statistics of particle energy distribution in classical and quantum systems including M-B, B-E and F-D distributions.

CO 3 the laws of black-body radiation and understanding of quantum nature of electromagnetic radiations

CO 4 Bose-Einstein condensation its role in understanding of a number of physical phenomena including properties of liquid helium

CO 5 Fermi energy and degenerate Fermi gas and their role in understanding of a number of physical phenomena including properties of specific heat, helium III, white dwarf, etc.

Physics Lab Experiments

8. To determine Planck constant using photo electric cell.
9. To determine the velocity of light as a quotient of optical path travelled by a light pulse and the transit time.
10. To study the variation of magnetic field along the axis of a circular coil carrying current and extimate the radius of the coil.
11. To demonstrate dia, para, ferromagnetism in homogeneous magnetic field.
12. To determine the specific heat capacity of solid using copper, lead and glass.

PYL202 Mathematical Physics II (3-1-0=4 Credits) 42 Lectures

Differential Equations and its Classification, Linear Ordinary Differential Equations First and second order (with examples from vibrations, heat conduction, diffusion etc.), Solution of Non-homogeneous Equations by D Operator Method. Bernoulli and Euler Equations. Coupled Differential Equations, Euler's Equation and its Application to Simple Problems, Hamilton's Principle. Poisson Brackets and their Properties.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To study the basics of differential equation and their classifications.
CO 2 To solve linear differential equation for various problems.
CO 3 To explore the properties of second order differential equations.
CO 4 To determine the different types of equations and their applications.
CO 5 To study the detailed knowledge about Lagrange Multipliers and their applications.

PYL 301 Atomic and Molecular Physics (3-1-2 = 5 Credits) 42 Lectures

Determination of e/m of the Electrons, Isotopes and Isobars. Mass spectrometry. X-rays Ionizing Power, Bragg's Law. X-rays-Spectra. Moseley Law. Orbital and spin quantization of electron angular momentum, associated magnetic moment, Larmor precession Theorem. Stern-Gerlach Experiment. Zeeman Effect (Normal and Anomalous). Paschen Black and Stark Effects (Qualitative Discussion only). Pauli's Exclusion

Principle. Symmetric and Antisymmetric Wave Functions. Electron distribution in elements and Periodic table. Fine structure. Spectral Notations for Atomic States. Total Angular Momentum L-S and J-J couplings. Hund's Rule. Spectra of Hydrogen and Alkali Atoms (Na etc.). Rotational Energy and Vibrational Energy Levels, Selection Rules Determination of Inter-nuclear Distance. Raman Effect. Quantum Theory. Stoke's and Anti-Stoke's Lines. Complimentary Character of Raman and infrared Spectra. Lasers: Einstein's A and B coefficients. Metastable states. Optical Pumping and Population Inversion. Ruby Laser and He-Ne Laser.

Course Outcomes (COs)

The learning gained as per the following COs will enable analyze XRD and XRF, infra-red and optical spectra, Raman spectra of materials These applications are crucial in analysis and synthesis of materials.

CO 1 e/m ratio of electrons, isotopes, isobars. Mass spectrometry, X-rays diffraction (XRD) and X-ray spectroscopy (XRF).

CO 2 orbital and spin quantization of electron angular momentum, associated magnetic moment, Larmor precession, various effects associated with electron magnetic moment in external magnetic and electric fields.

CO 3 Pauli-exclusion principle, Electron distribution in elements and Periodic table. Spectra of hydrogen and alkali atoms.

CO 4 Various degrees of freedom of molecular motion, associated energy levels and molecular spectra.

CO 5 Raman effect, theory, spectra and comparison with infrared spectra.

CO 6 Principle of laser, components of laser, characteristics and ruby, He-Ne lasers.

Physics Lab Experiments

10. To determine the fill factor of photovoltaic cell.
11. To verify and design AND, OR, NOT and XOR gates using NAND gates.
12. To design a combinational logic system for a specified Truth Table.
13. To design a Seven-Segment Display driver.
14. Half Adder, Full Adder and 4-bit Binary Adder.
15. Half Subtractor, Full Subtractor, Adder-Subtractor using Full Adder I.C.
16. To build Flip-Flop Circuits using elementary gates (RS, Clocked RS, D-type, and JK Flip-Flop).
17. To build a 4-bit Counter using D-type/JK Flip-Flop.
18. To make a Shift Register from D-type/JK Flip-Flop. 4. Serial and Parallel shifting of data.
19. To covert Voltmeter to Ammeter and vice versa. (Electricity and Magnetism)

MAL 310 Numerical Analysis (3-0-2 = 4 Credits) 28 Lectures

Error Estimation. Floating Point Computation. Single and Double Precision Arithmetic. Fixed-Point Iteration Method. Newton- Raphson Method. Generalized Newton's Method. Matrices and Solution of Linear System of Equations. Computation of Eigenvalues and Eigenvectors of Matrices by using Iterative Methods. Interpolation methods. Newton's General Interpolation Formula. Curve Fitting, Linear Weighed Least Square Approximation. Orthogonalization Process. Cubic B-Splines. Approximation of Functions. Chebyshev Polynomials. Numerical Differentiation. Maximum and Minimum Values of a Tabulated Function. Numerical Integration. Gauss- Hermite and Gauss-Legendre Formulas. Solution of Ordinary Differential Equations (ODE's), Euler's and Runge-Kutta Method of Second Order with Error Estimation. Second Order ODEs. Finite Difference Method.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 Students should be able to understand numerical solutions of non-linear/ transcendental equations.

CO 2 Students should be able to apply various algorithms to solve system of linear equations.

CO 3 Students should be able to approximate mathematical functions and find intermediate values using interpolation techniques.

CO 4 Students should be able to apply numerical techniques for differentiating and integrating the non-analytical functions

CO 5 Students should be able to apply numerical techniques to solve various differential equations of engineering importance

PYL 301 Digital Electronics (3-1-2 = 5 Credits) 42 Lectures

Block Diagram of CRO. Electron Gun, Deflection System and Time Base, Applications of CRO, Integrated Circuits (Qualitative Treatment only) :- Active and Passive components. DiscreteCircuit Component. Wafer. Chip. Advantages and Drawbacks of ICs. Scale of integration :SSI, MSI, LSI and VLSI Classification of ICs. Fabrication of Components on Monolithic ICs. Examples of Linear and Digital ICs. Operational Amplifiers, Operational Amplifiers Timers and its Applications , Difference Between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. AND, OR and NOT Gates , NAND AND NOR Gates. Exclusive OR and Exclusive NOR Gates. Boolean algebra, De Morgan's Theorems, Simplification of Logic Circuit using Boolean Algebra,Fundamental Products, Minterms and Maxterms, Karnaugh Map, Data processing Memories (ROM), PROM, EPROM, Arithmetic Circuits , Sequential Circuits , Shift registers Counters , D/A and A/D conversion

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To understand CRO.

CO 2 To have in-depth knowledge of analog circuits.

CO 3 To have in-depth knowledge of digital circuits.

CO 4 To understand principle of operational amplifier and its use.

Physics Lab Experiments

1. To determine the fill factor of photovoltaic cell.
2. To verify and design AND, OR, NOT and XOR gates using NAND gates.
3. To design a combinational logic system for a specified Truth Table.
4. To design a Seven-Segment Display driver.
5. Half Adder, Full Adder and 4-bit Binary Adder.
6. Half Subtractor, Full Subtractor, Adder-Subtractor using Full Adder I.C.
7. To build Flip-Flop Circuits using elementary gates (RS, Clocked RS, D-type, and JK Flip-Flop).
8. To build a 4-bit Counter using D-type/JK Flip-Flop.
9. To make a Shift Register from D-type/JK Flip-Flop. 4. Serial and Parallel shifting of data.
10. To covert Voltmeter to Ammeter and vice versa. (Electricity and Magnetism)

PYL 302 Nuclear and Particle Physics (3-1-0 = 4 Credits) 42 Lectures

Structure of nuclei, Radioactivity, Law of Radioactive Decay, Half-life, Radioactive Series, Binding Energy, Mass Formula., α-decay :- Range of α-particles, Geiger-Nuttal law and α-particle Spectra, β-decay :- Energy Spectra and Neutrino Hypothesis. γ-decay: - Origin of γ-rays, Nuclear Isomerism and Internal Conversion, Nuclear Reactions :- Types of Reactions and Conservation Laws. Concept of Compound and Direct Reaction, Attractive and Repulsive Potential Barriers. Scattering Cross-section, Reaction Rate. Q-value of Reaction, Fission and Fusion, Nuclear Models: - Liquid Drop Model, Mass formula, Shell Model, Accelerators :- Van de Graaff Generator, Linear Accelerator, Cyclotron, Betatron, and Light and Heavy Ion Synchro-Cyclotron. Idea of Large Hadron Collider, Ionization chamber, GM Counter, Scintillation Detectors, Elementary Particles, Classification of Elementary Particles, Baryons, Hyperons, Leptons, and Mesons, Supermultiplets of Mesons and Baryons, Conservation Laws and Symmetry, Different Types of Quarks and Quark Contents of Spin, Baryons, Photons, Gravitons, Gluons, Idea of Standard Model, Higg's Boson.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To study the depth knowledge of structure of nuclei i.e its mass, stability, binding energy etc.

CO 2 To distinguish between alpha, beta and gamma decay and study their energy spectra.

CO 3 To study the different types of nuclear reactions, nuclear models and their advantages.

CO 4 To identify the different types of acceralators, detectors and their industrial applications.

CO 5 To study the different types of particles and antiparticles and their classification.

PYL 305 Electronic Devices (3-1-0 = 4 Credits) 42 Lectures

Circuit Analysis, Wheatstone Bridge and its Applications to Wein Bridge and Anderson Bridge. Semiconductor Diodes Barrier Potential, Barrier Width and Current for Step Junction. pn junction and its characteristics, Static and Dynamic Resistance, Diode Equivalent Circuit, Ideal Diode., Load Line Analysis of Diodes.Load Line and Q-point. Rectifier Diode. Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers , Zener Diode and Voltage Regulation Photo Diode, Tunnel Diode, LED , Varactor Diode. Bipolar Junction transistors Characteristics of CB, CE and CC Configurations. Current gains , Load Line Analysis Q-point. Amplifiers. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Resistance,Voltage and Power Gains. Class A, B, and C Amplifiers., Coupled Amplifiers , Feedback in Amplifiers, Sinusoidal, Hartley Oscillator. Colpitts Oscillator., Non-Sinusoidal Oscillators – Astable and Monostable Multivibrators. UJT : Its Chararacteristics and Equivalent Circuit, Relaxation Oscillator, JEFT : Its Characteristics and Equivalent Circuit. Advantagesof JFET. MOSFET Modulation and Demodulation

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To understand the basics of bridges

CO 2 To have in depth knowledge of diodes

CO 3 To have basic idea of amplifications

CO 4 To understand the oscillators

Programme Elective I

PYL205 Lasers (3-1-0=4 Credits) 42 Lectures

Introduction to lasers **:**Black body radiation - Lifetime of excited state - Decay of excited states - Condition for producing laser - Gain and gain saturation - Saturation intensity - Threshold condition - Requirements for obtaining population inversion Steady state and transient population processes. Gas lasers: He-Ne laser, Argon-ion, Nitrogen laser - Carbondioxide laser, Excimer laser - Chemical laser - X-ray laser - Free electron laser. Solid state, semiconductor and liquid lasers: Pumping mechanism, Ruby laser - Nd:YAG - Nd:Glass - Er doped laser – Ti-Sapphire laser - Intrinsic semiconductor laser - Doped semiconductor - Condition for laser action, Injection laser - Threshold current - Homojunction – Hetrojunction - Double hetrojunction lasers - Quantum well laser - Liquid lasers - Pulsed-CW dye laser - Threshold condition - Configuration - Tuning methods. Application of lasers.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To provide the basic concepts Lasers and to provide working knowledge in the instruments
CO 2 To provide adequate knowledge about industrial applications of Lasers.
CO 3 To provide adequate knowledge about lasing condition and population inversion
CO 4 To provide adequate knowledge about tuning methods.

PYL207 Nuclear, Particle and Astrophysics (3-1-0=4 Credits) 42 Lectures

Properties of Nuclues: General properties of the atomic nuclei, nuclear charge, elementary idea of nuclear fission and fusion. Qualitative discussion of the nature of nuclear forces.Radioactive Decay and Interaction of Nuclear Radiation with Matter :Radioactive series decay, Qualitative discussion of alpha, beta and gamma-decays, Nuclear radiation detectors Particle Physics: Basic interactions and their mediating quanta, classification of particles, idea of resonances, conservation rules in fundamental interactions, determination of spin and parity of pions, strange particles, isospin and its conservation, quarks, their quantum numbers and quark model. Cosmic Rays and Astrophysics Primary cosmic rays, Production secondary cosmic rays, Structure of the sun, stellar energy source, p-p and C-N-O cycles and their temperature dependence, H-R diagram, white dwarf and Chandrasekhar mass limit, neutron star and pulsar, Schwarzschild radius and Black Holes.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To explain the different properties of atomic nuclei and nature of nuclear forces

CO 2 To explain radioactive decay and interaction of nuclear radiation with matter

CO 3 To classify particles and explain the conservation rule in fundamental interactions

CO 4 To explain the primary cosmic rays and production of secondary cosmic rays.

CO 5 To explain different astrophysical phenomena

PYL110 Fundamentals of Electronic Communication (3-1-0=3 Credits) 28 Lectures

Introduction to Communication System, Modulation and Demodulation techniques, Antenna and Radio Wave Propagation, Radio receiver and Television, Telephone System

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 Acquired knowledge about basic analog and digital communication

CO 2 Knowledge about technology used in communication

CO 3 Capable of performing various antenna measurements

CO 4 Ability to identify characteristics of radio wave propagation

CO 5 To learn about basic telephone system

Programme Elective II

PYL206 Nonlinear Optics (3-1-0)

Light matter interaction, Nonlinear perturbation theory and coupled mode equations, Anharmonic oscillator model, second and third order effects, phase-matching mechanisms, vibrational transitions in molecules and Raman-nonlinearity, Kerr nonlinearity.

Course Outcomes (COs)

After the successful completion of the course, the students will be able to;

CO 1 Understand the light matter interaction and origin of Nonlinear optics (NLO).

CO 2 Have indepth knowledge of optical processes of NLO,having the potential of industrial applications.

CO 3 Understand the scattering of light at high intensity.

CO 4 Know about intensity dependent refractive index and various types of nonlinearities for technological importance.

PYL208 BioPhysics (3-1-0)

Advanced Nuclear Magnetic Resonance, Biomolecular structure determinations, Microscopy, Fluorescence,Tomography & 3D single-particle reconstruction, Analysis of structure using Electrostatics - potentials & pKs, Molecular Dynamics, Mass Spectrometry, Theory & instrumentation, Foot printing & dynamics

Course Outcomes (COs)

After successful completion of the course students will be able to

CO 1 Attain the understanding of magnetic resonance and its applications.

CO 2 Know the role of physics in biological materials.

CO 3 Analyze the structure of biomolecules and its applications in medical fields.

CO 4 Have understanding of interaction of radiation with biomaterial.

ASL310 Polymer Composite (3-0-2=4Credits) 28 Lectures

Fundament of polymer materials, mechanism of polymerization, classification of composites, natural fibres (jute, cellulose), carbon fibres, resins, characterization methods of polymer and composites such as (TGA, DTA, IR, NMR, UV-visible), Mechanical properties of polymer and composites (tensile strength, modulus, shear strength etc). Application of Polymer Composite in various industries; Textile, Automobile, Aerospace, Building and Construction. Project work and case studies.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 Students would be aware of the basic concepts of polymers, polymerization process and relate examples with daily life applications.

CO 2 Students would be aware of the basic concepts of composites and process to form polymer composites using different fibers. This knowledge would be useful for industry and technology perspectives..

CO 3 Student would understand the various properties of polymer and composites and the analytical techniques which can use for the identification of composites materials.

CO 4 Students would be able to correlate the application of polymer technology to industries.

Programme Elective III

PYL305 Experimental and Analytical Techniques in Material Science (3-0-2=4 credits) 28 Lectures

Band theory of solids: Free electron theory, Kronig-Penny model, Band formation in solids, Introduction to “real” (defect-containing) solids, equilibria and kinetic processes in solids. Doping in solids. Semiconductor basics, intrinsic and extrinsic semiconductors-n & p-type, Fermi level, carrier concentration, mobility, conductivity.

Crystalline Semiconductors: Growth, Diffusion, ion implantation, oxidation, microlithography, plasma etching, thin film deposition, Introduction to compound semiconductors.

Non-crystalline Semiconductors: Phase diagrams, Formation of inorganic semiconductor glasses. Viscosity and structural relaxation. Phase separation and crystallization. Phase diagrams; The phase rule, single component systems, binary phase diagrams, micostructural changes during cooling, the Lever rule, some typical phase diagrams; magnesia-alumina system, copper-zinc system, iron-iron-carbide system, Diffusion in solids; Ficks laws of diffusion, solution to Ficks second law and its applications, the Kirkendall effect, the atomic model of diffusion, Phase transformations; time scale for phase changes, Nucleation and growth; the nucleation kinetics, the growth and overall transformation kinetics.

Course Outcomes (COs)

Possible usefulness of this course after its completion

CO 1 Students will be able to have indepth knowledge of crystals and XRD

CO 2 Students will be having understanding of growth of crystalline semi conductors.

CO 3 Students will beapply the knowledge of analytical techniques for material characterization. in industries

CO 4 The spectroscopic techniques will be well understood and can be implemented in industry and in medical applications.

PYL307 Fiber Optics (3-0-2=4 Credits) **42 Lectures**

Optical fibers and their properties: Basic optical laws and definitions– Principles of light propagation through a fiber – Different types of fiber and their properties – Modes of propagation – Attenuation - Signal distortion in optical waveguides – Pulse broadening in graded index waveguides – Absorption losses – Scattering losses – Dispersion – Connectors & Splicers **Fiber**Optical sources and optical detector: Optical sources – LED structures – types of LED – planar – dome – surface emitting – Light source materials – Quantum efficiency and LED power – Modulation of an LED.Optical detectors – Principles of photo detection – PIN photodiode – Avalanche photodiode and its characteristics, Industrial applications of optical fibers: Fiber optic sensors – Fiber optic instrumentation system – Different types of modulators –Interferometric method of measurement of length – Moire fringes – Measurement of pressure –temperature – current – voltage – liquid level and strain, Holography & applications: Holography – Basic principles – Methods of holographic interferometry and applications –Holography for NDT – Medical application of lasers – Laser and tissue interaction – Laser instruments for surgery – Removal of tumors of vocal chords – Brain surgery – Plastic surgery –Gynecology – Oncology

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To provide the basic concepts of optical fibers and to provide knowledge about optical sources and optical detectors

CO 2 To provide adequate knowledge about industrial applications of optical fibers.

CO 3 To provide adequate knowledge about Laser fundamentals and to provide adequate knowledge about Industrial application of lasers.

CO 4 To provide adequate knowledge about holography & Medical applications of Lasers.

PYL303 Microprocessor (3-0-2 = 4 Credits) 28Lectures

Hexadecimal Number System and Arithmetic. Computer organization. Input / Output

Devices. Data Storage. Computer Memory. Memory Organization and Addressing. Memory Interfacing. Memory Map. Intel 8085 Microprocessor Architecture Main Features of 8085. Block Diagram. Components. Pin-out Diagram. Buses. Registers. ALU. Memory. Stack Memory. Interfacing Devices. Timing and Control Circuitry. Timing States. Instruction Cycle (Timing Diagram). Interrupts and Interrupt Control. Input / Output.

8085 Instructions :- Instructions. Machine Language. Assembly Language. Instruction Set and Format. Data Transfer, Arithmetic, Logical, Branching and Machine Control Operations. RIM and SIM. Addressing Modes : Register, Implied, Immediate, Direct and Indirect. Microprocessor Programming :- Algorithm and Flowcharts. Simple programming Exercises : Addition, Subtraction, Multiplication and Division - Both 8 and 16 bit etc.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 Identify the basic elements and functions of 8085 and 8086 microprocessors

CO 2 Explain the architecture and operation of 8085 and 8086 microprocessors

CO 3 Understand the instruction sets of 8085 and 8086 and identify timing sequence of different instructions

CO 4 Apply the programming techniques in designing simple assembly language programs for solving simple problems by using instruction sets of microprocessors

CO 5 Identify and explain the operations of peripherals and memories typically interfaced with microprocessors

CO 6 Review some advancements in latest technological trends through features of current and advanced microprocessors

Programme Elective IV

PYL308 Optical Communication (3-0-2=4 Credits) 42 Lectures

Introduction to optical communications, ray theory, geometrical optics approach, wave theory approach, types of fiber, modes in step and graded index fiber, losses in fiber-linear and non-linear losses, Solutions, optical sources- and detectors with their working principle and characteristics, various receiver configuration-direct detection, homodyne, hetrodyne receivers, noise sources in optical communication, optical fiber link design, optical components: optical switches, SOA, EDFA, mux/demux, couplers, introduction to optical space communication, fiber in local loop.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 To provide the basic concepts of optical fibers and to provide knowledge about optical sources and optical detectors

CO 2 To provide adequate knowledge about industrial applications of optical fibers.

CO 3 To provide adequate knowledge about Laser fundamentals and to provide adequate knowledge about Industrial application of lasers.

CO 4 To provide adequate knowledge about holography & Medical applications of Lasers.

PYL 306 Thin Films and Nanomaterials (3-0-2=4 Credits) 42 Lectures

Difficulties with classical physics, Planck's constant, Introduction to quantum mechanics-simple concepts, Phase velocity and group velocity, Schrodinger wave equations (time independent), Concept of stationary states, Particle in a one-dimensional box Basic understanding of Nanotechnology, Nanoscale Beyond Moore's Law, Quantum Confinement. Quantum Dot, Quantum Wire, Nanorods, metallic nanoparticles, graphene and graphene oxide, semiconductor quantum dots nanocrystals, Porous Silicon, Aerogels, Nanoshells, Nanofluids, Carbon Nanotubes, Fullerenes, Graphenes. Dangling Bonds, Physiochemical Properties, Linear and Nonlinear Optical Properties of Nanomaterials, Synthesis of nanomaterials, Characterization of nanomaterials: UV-VIS absorption spectrophotometer, LCR meter, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning Tunneling Microscopy (STM), Scanning Force Microscopy (SFM), Atomic Force Microscopy (AFM), Z-Scan. Applications of nanomaterials.

Course Outcomes (COs)

On successful completion of the course, the students will be able

CO 1 To understand the basics of nanomaterials by simple concepts of Quantum mechanics.

CO 2 To categories different types of nanomaterials and its applications.

CO 3 To gain good knowledge of properties of nanomaterials.

CO 4 To explore the different techniques for synthesis of nanomaterials.

CO 5 To have indepth knowledge of characterization techniques of various nanomaterials.

Ability Enhancement Courses

CLL101 Effective Communication- I (1-0-2 = 2 Credits)

Vocabulary-1, Word building and enriching vocabulary Essentials of Grammar-1 Errors pertaining to Nouns, Pronouns, Verbs, Adverbs and Adjectives Writing Skills-1 Business Correspondence, Reading Skills-1 Theme detection, Literal comprehension Speaking Skills-1: Introducing oneself mini presentation, collaborative task, Listening Skills-1: Listening specific information, theme detection, gap filling.

CLL102 Effective Communication- II (1-0-2 = 2 Credits)

Vocabulary-2 Technical vocabulary, foreign expressions.Essentials of Grammar-2 Errors pertaining to Articles, Prepositions, Non-finites and conjunctions.Writing Skills-2 Resume Writing, Reports and Proposals. Reading Skills-2 Analytical reading, Reading for cohesion and proof reading Speaking Skills-2 Group Discussion, Role playing activities, Public speaking, Simulated conversation, Facing Interview, Presentation skills, Business etiquette. Listening Skills-2 Listening short pieces for gist and analytical comprehension.

ASL140 Environmental Studies (3-0-0 = 3 Credits)

The Multidisciplinary nature of environmental studies, Natural Resources, Ecosystem, Biodiversity and its conservations, Environmental Pollution, Social issues and the Environment, Human population and the Environment, Field Work.

Course Outcomes (COs)

Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed

CO 1 Application of knowledge gained to generate awareness for environmental protection so as to sensitize the student community towards environmental management and becoming Green Citizens and to apply the knowledge gained in sustaining various resources by using green technologies.

CO 2 To apply the concepts learnt in maintaining balance in natural ecosystems and it covers all aspects of life and contributes in constructive decision-making keeping environment in view.

CO 3 Development of understanding of pollution and to develop an understanding of Environmental management to enable them in becoming green engineers and green managers. To become green citizens and contribute in the sustainable development of the society, country and the world.

CO 4 To apply the concepts learnt in earning resources for their organizations by using green technologies.

CO 5 It encapsulates sound theoretical base of all the environmental aspects coupled with practical and projects.