University of Barisal

FACULTY OF SCIENCE

Department of Physics

Syllabus for B.Sc. (Honours) in Physics
Session 2014-15 and 2015-16

Degree name: B.S. (Hons.) in Physics
Course structure:
Program duration: 4 Years
Number of semesters: 8
Total number of credit hours available: 146
Minimum credit hours is required to earn to be a graduate: 146

Year-wise distribution of credits

Year	Term	Credits
1st year	First	19.0
	Second	20.0
2nd year	First	16.5
	Second	19.0
3rd year	First	19.5.0
	Second	16.5
4th year	First	16.5
	Second	19.0
	Total	146

The course duration of the B.Sc. (Honours) programme is four years and is semester based. Each year consists of two semesters (1st and 2nd). For the 2014-15 Session the whole programme consists of 146 among which 126 are allocated for theory courses, 12 credits for laboratory courses, and the rest 8 credits, for general viva.

Preamble

The Department of Physics is one of the largest and rich departments of The University of Barisal, Barisal. The Department has now two Assistant Professors and six Lecturers. It offers B.Sc. (Honours) and M.Sc. degree in physics under the Faculty of Science. The M.Phil./PhD Programme is going to start very soon.

A semester-final examination will be held at the end of each semester. The final examination will carry 60% of the total marks and continuous assessment (mid-term/attendance/ presentation/ class test/ class performance/ assignment/ quiz test) will carry 40% marks. For each of the theory courses, there will be at least two mid-term examinations. For each of the theory courses, there will be at least two mid-term examinations. To appear in the final examination as a regular student, one must have percentage not below 75%. However, the chairman of the department may recommend the students having percentage between 60% to less than 75% after paying fees determined by the university authority.

For 4 (four) credit courses the duration of examination will be 4 (four) hours; there will be 8 (eight) questions from which 5 (five) to be answered. For 3 (three) credit courses the duration of examination will be 3 (three) hours; there will be 8 (eight) questions from which 5 (five) to be answered. For 2 (two) credit courses the duration of examination will be 2 (two) hours; there will be 5 (five) questions from which 3 (three) to be answered.

Total marks obtained in each course will be converted into LG (Letter Grade) and GP (Grade Point) as follows:

Numeral Grade	Letter Grade		Grade Point	Interpretation
80% and above	A+	(A plus)	4.00	Outstanding
75% to less than 80%	A	(A regular)	3.75	Excellent
70% to less than 75%	A-	(A minus)	3.50	Very Good
65% to less than 70%	B+	(B plus)	3.25	Good
60% to less than 70%	B	(B regular)	3.00	Satisfactory
55% to less than 60%	B-	(B minus)	2.75	Bellow Satisfactory
50% to less than 55%	C+	(C plus)	2.50	Average
45% to less than 50%	C	(C regular)	2.25	Pass
40% to less than 45%	D		2.00	Poor
Less than 40%	F		0.00	Fail

The promotion in the department is yearly based. Students must have to earn a minimum CGPA 2.00 to get promotion from 1st year to 2nd year, and 2.25 from 2nd year to 3rd year and 3rd year to 4th year. If any student fails to get the requisite CGPA for promotion, he/she may seek readmission with the 1st semester of the respective year with the subsequent available batch. If a student gets required GPA/CGPA for promotion in any odd semester but failed to get required CGPA in even semester, he/she may seek readmission with the even semester of the same year with the next available batch.

A student earning ‘F’ grade in any theoretical/practical course of any semester will be required to improve ‘F’ grade(s) with the next available two consecutive batches. In case of students of 4th year who have already readmitted once or twice, the bindings of

completion of the programme with 6 (six) academic years may be relaxed for two more consecutive academic years to clear the 'F' grades of the courses of 4th year 1st and 2nd semester, if any. Students earning the letter grade of less than 'B' (GP 3.00) in any theoretical course may choose to improve the grade by appearing at the semester-final examination with the next available batch. In case of improvement of the courses of 4th year, the bindings of completion of the programme within 6 (six) academic years may be relaxed to one more academic year.

SEMESTER WISE COURSE DISTRIBUTION

Semester I

Course Code	Course Title	Credit
PHY-101	Mechanics and Properties of Matter	3.0
PHY-102	Electricity & Magnetism	3.0
PHY-103	Physical Chemistry	2.0
PHY-104	Computer Fundamentals	2.0
PHY-105	Computer Fundamentals Lab	1.5
PHY-106	English	2.0
PHY-107	Differential & Integral Calculus	3.0
PHY-108	Physics Lab-I	1.5
PHY-109	Viva	1.0
	Total Credit in 1st Semester	**19.0**

Semester II

Course Code	Course Title	Credit
PHY-201	Waves & Oscillation	3.0
PHY-202	Mathematical Physics-I	3.0
PHY-203	Heat & Thermodynamics	3.0
PHY-204	Inorganic and Organic Chemistry	2.0
PHY-205	Chemistry Lab.	1.5
PHY-206	Statistics	3.0
PHY-207	Linear Algebra	2.0
PHY-208	Physics Lab-II	1.5
PHY-209	Viva	1.0
	Total Credit in 2nd Semester	**20.0**

Semester III

Course Code	Course Title	Credit
PHY-301	Optics-1	3.0
PHY-302	Electronics-1	3.0
PHY-303	Classical Mechanics	3.0
PHY-304	Mathematical Physics-II	3.0
PHY-305	Co-ordinate Geometry	2.0
PHY-306	Physics Lab- III	1.5
PHY-307	Viva	1.0
	Total Credit in 3rd Semester	**16.5**

Semester IV

Course Code	Course Title	Credit
PHY-401	Atomic & Molecular Physics	3.0
PHY-402	Electronics-II	3.0
PHY-403	Relativity: Special & General	2.0
PHY-404	Optics-II	3.0
PHY-405	Computer Programming	2.0
PHY-406	Computer Programming Lab	1.5
PHY-407	Numerical Analysis	2.0
PHY-408	Physics Lab- IV	1.5
PHY-409	Viva	1.0
	Total Credit in 4th Semester	**19.0**

Semester V

Course Code	Course Title	Credit
PHY-501	Nuclear Physics-I	3.0
PHY-502	Quantum Mechanics-I	3.0
PHY-503	Solid State Physics – I	3.0
PHY-504	Electrodynamics-I	2.0
PHY-505	Radiation and Statistical Mechanics	3.0
PHY-506	Digital Electronics	3.0
PHY-507	Physics Lab- V	1.5
PHY-508	Viva	1.0
	Total Credit in 5th Semester	**19.5**

Semester VI

Course Code	Course Title	Credit
PHY-601	Nuclear Physics-II	3.0
PHY-602	Quantum Mechanics-II	3.0
PHY-603	Solid State Physics – II	3.0
PHY-604	Plasma Physics	3.0
PHY-605	Electrodynamics-II	2.0
PHY-606	Physics Lab- VI	1.5
PHY-607	Viva	1.0
	Total Credit in 6th Semester	**16.5**

Semester VII

Course Code	Course Title	Credit
PHY-701	Nuclear Physics- III	3.0
PHY-702	Quantum Mechanics-III	3.0
PHY-703	Solid State Physics – III	3.0
PHY-704	Material Science	3.0
PHY-705	Geophysics	2.0
PHY-706	Physics lab- VII	1.5
PHY-707	Viva	1.0
	Total Credit in 7th Semester	**16.5**

Semester VIII

Course Code	Course Title	Credit
PHY-801	Astrophysics and Cosmology	3.0
PHY-802	Radiation and Health physics	3.0
PHY-803	Biomedical Physics	3.0
PHY-804	Electronic Communication	2.0
PHY-805	Reactor Physics	3.0
PHY-806	Renewable Energy	2.0
PHY-807	Physics Lab-VIII	2.0
PHY-808	Viva	1.0
	Total Credit in 8th Semester	**19.0**

Total Credit:

Semester	Credit
1st Semester	19.0
2nd Semester	20.0
3rd Semester	16.5
4th Semester	19.0
5th Semester	19.5
6th Semester	16.5
7th Semester	16.5
8th Semester	19.0
Total	**146.0**

1st Semester

Course Code: PHY-101	Course Title: Mechanics and Properties of Matter	Credit: 3.0

1. **Preamble:** Measurement of physical variables; Dimensions of physical variables and rudimentary dimensional analysis scaling.
2. **Particle Kinematics and Dynamics:** Motion in one dimension: x Vs. t, v Vs. t graphs and their properties; Motion in two and three dimensions: projectile motion, circular motion; Notion of force and Newton's law of motion; Frictional forces; Application of Newton's law.
3. **Momentum Conservation and System of Particles:**
   a) Conservation of momentum: rocket motion; Center of mass and its motion.
   b) Collision: elastic and inelastic collision in one dimension; Impulse.
4. **Energy Conservation:** Work and energy; the work-energy theorem; Conservative force and potential energy and their relation; Conservation of energy.
5. **Rotational Kinematics and Dynamics:** Relation between linear and angular kinematics for a particle in circular motion; Torque acting on a particle; Angular momentum; Conservation of angular momentum; The rotational dynamics of a rigid body.
6. **Rotational Motion:** Rotational kinematics; Moment of inertia and its calculation; Radius of gyration; Parallel-axis Theorem; Perpendicular-axis theorem; Rolling motion; Motion of a heavy symmetric top; Precessions.

7. **Gravitation:** Newton's law of gravitation; Derivation of Kepler' slaws of planetary motion from Newton's laws; Gravitational potential and field; Escape velocity; Calculation of potential and force in simple cases.
8. **Elasticity:** Stress and strain; Hook's law; Three types of elasticity; Relation between elastic constants; Poisson's ratio; Yield point; Elastic limit; Elastic fatigue; Limiting value ofσ ; Bending of beams; Cantilever, Torsion.
9. **Surface Tension and Viscosity:**
   - **i)** Adhesive and cohesive forces; Molecular origin of surface tension; Excess pressure due to surface tension at an interface; Capillarity.
   - **ii)** Newton's law of viscosity; Poiseuille's formula; Stokes' law; Terminal velocity for falling bodies.
10. **Rudiments of Fluid Dynamics:** Concept of fluid flow; Stream line flow and turbulent flow; Bernoulli's equation; Equation of continuity and their applications; Euler's Equation.

Books Recommended:			
	Authors		**Books**
1.	*D. Halliday, R. Resnick& K.S. Krane*	**:**	Physics Vol. 1
2.	*B. Brown*	**:**	General Properties of Matter
3.	*D.S. Mathur*	**:**	Properties of Matter
4.	*BrijLal & N. Subrahmanyam*	**:**	Properties of Matter

Course Code: PHY-102	Course Title: Electricity & Magnetism	Credit: 3.0

1. **Electric Field:**
    a) Point charges and Coulomb's law; Definition of Electric field; Electric field lines; Calculation of **E**; A point charge in an electric field; Electric field due to a dipole; Torque on a dipole in a uniform electric field.
    b) Flux of the electric field; Gauss's law and its applications; Coulomb's law from Gauss's law; Cases with planar, Spherical and cylindrical symmetry; Calculation of **E** from V; Gauss's law in differential form.
    c) Static electric field as a conservative vector field; Notion of a potential; Equipotential surfaces; Potential and potential energy for a system of charges.
    d) Capacitance and capacitor; Analogy with springs; Parallel plate capacitors and spherical Capacitors; Energy stored in a capacitor; Capacitors in parallel and series; Concept of electron-volt; Electric field as the carrier of electrical energy and electrical energy density in terms of electric field.
    e) Dielectric media; Polarization vector, displacement vector and electric vector; Capacitor with a dielectric; Gauss's Law with dielectric.

2. **Current and Magnetic Field:**
    a) Motion of charge carrier in matter; Current density; Drift velocity; Conductors and Ohm's law; Resistance and resistivity; Addition of resistances.

b) Electromotive force and potential drop; Kirchoff's law: junction and loop rules and their physical basis; Problems involving multi-loop circuits with resistor and batteries; Ammeter, voltmeter and their uses.
c) Single loop RC circuit: charging and discharging of a capacitor and the time constant.
d) Definition of magnetic field; Lorentz force; Properties of static magnetic fields; Gauss's law for magnetic fields; Motion of charged particles in magnetic fields; Hall effect.
e) Magnetic fields due to current; Biot-Savart Law; Magnetic fields due to current carrying conductors; Ring current as a magnetic dipole; Ampere's law; Comparison between Biot-Savart law and Ampere's law; Field due to an infinite straight wire; Ideal solenoid and toroid.
f) Magnetic properties of matter: Paramagnetism, diamagnetism and ferromagnetism; Magnetization vector; Hysteresis.

3. Time Varying Phenomena:

a) Faraday's law of electromagnetic induction; Lenz's law; Induction: self and mutual induction; Transformers.
b) Inductors; Single loop RL circuit and the time constant; Energy stored in magnetic fields.
c) Induced electric fields from time varying magnetic fields; Synchrotron and cyclotron.
d) LC circuits; Energy transformation in LC circuit; Damped oscillation in LCR circuits.
e) Alternating currents; RMS Value; Use of complex variables and Phasors for linear circuit analysis; Impedance and reactance; Q-factor and power factor;

Response of RC, RL and RLC circuits to alternating currents.

Books Recommended:			
	Authors		**Books**
1.	*D. Halliday, R. Resnick& K.S. Krane*	**:**	Physics vol. 2
2.	*A. Kip*	**:**	Fundamentals of Electricity and Magnetism
3.	*K.K. Tewari*	**:**	Electricity and Magnetism with Electronics
4.	*H.D. Young*	**:**	University Physics

Course Code: CHM -103	**Course Title: Physical Chemistry**	**Credit: 2.0**

1. **Chemical Analysis:** Types of chemical analysis: Qualitative analysis, Quantitative analysis, Volumetric analysis; Types of titrations; Requirement of volumetric analysis; Acidimetry and alkalimetry; Primary and secondary standard substance; Different units of concentration; Equivalent weight of an acid, base, salt and oxidizing and reducing agents; Preparation of standard solution; Theory of neutralization reaction.
2. **Solution:** Types of solution; Factors influencing the solubility of a substance; Mechanism of dissolution; Liquefaction of gas; Properties of dilute solution; Osmotic pressure; Raoults' law of vapor pressure; Elevation of boiling point and depression of freezing point and their experimental determination.

3. **Chemical Kinetics:** First and second order reactions and their simple treatment; Simple theories for reaction rate (only outline of Arritenuum theory); Determination of order of reaction; Collision theory.
4. **Electrochemistry:** Electrolytic dissociation; Electrolytic conductance measurement; Ionic migration and transport number; Ionic product of water; Solubility product communion effect; e.m.f. of cells and their measurements; Buffer solutions; Indications; Concept of pH.
5. **Chemical Equilibrium:** Law of mass action; Effects of temperature, pressure and concentration on chemical equilibrium; Relationship between k_p and k_c.
6. **Surface Chemistry and Colloids:** Absorption, Langmuir absorption isotherm; Colloids-classification, preparation, purification, properties and importance; Elementary ideas about emulsion and gels.

Books Recommended:			
	Authors		**Books**
1.	*Daniels and Alberty*	**:**	Physical Chemistry
2.	*S. Glasstone*	**:**	Physical Chemistry
3.	*P.C. Rakshit*	**:**	Physical Chemistry
4.	*M.M. Hoque and M.A. Nawab*	**:**	Principles of Physical Chemistry
5.	*Bahl and Tuli*	**:**	Essentials of Physical Chemistry

Course Code: CSE-104	**Course Title: Computer**	**Credit: 2.0**

1. **Computer Fundamentals:** Evolution of computers; Elements of a computer system; Types of computer; Basic

computer architecture; Applications of computer, Number systems and fundamental logic gates.

2. **Personal Computer Hardware:** Processor; Main memory; Input and output devices; Storage devices; Modem.
3. **Softwares:** Categories of softwares; System softwares; Functions of an operating system; Types of processing; Language translators; Utility programs; PC operating systems; Computer viruses: categories and preventions.
4. **Application Software:** Word-processing: creating, editing and formatting features; Spreadsheet: creating and editing worksheets; Spreadsheet analysis: formula, functions and charting features; Multimedia presentations.
5. **Networking and Internet:** Different types of networks; Network topologies; Communication media; Internet services: e-mail and e-commerce.

Books Recommended:			
	Authors		**Books**
1.	*V. Rajaraman*	**:**	Fundamentals of Computers
2.	*S. k. Sarkar and A. K Gupta*	**:**	Elements of Computer Science
3.	*Peter Norton and John Goodman*	**:**	Inside the PC
4.	*Peter Norton*	**:**	Introduction to Computers
5.	*M. Lutfar Rahman*	**:**	Computer Fundamentals
6.	*ITL Education Solutions Limited*	**:**	Introduction to Computer Science

Course Code: CHE-105	Course Title: Computer Fundamentals Lab.	Credit: 1.5

1. **Operating System**: Windows: students will learn the basics of computer and how to operate them in Windows OS.
2. **Word Processor:** Students will learn to use a popular word processor to create a camera-ready text file complete with figures, columns and tables.
3. **Spread Sheet:** Students will learn to use a popular Spread Sheet to maintain a small database, minor book keeping and statistical and graphical analysis of data.
4. **Presentation Package:** Students will learn how to create multimedia slides and animation.

Books Recommended:			
	Authors		**Books**
1.	*Norton, P Peter Norton's*	**:**	Introduction to Computers
2.	*SE Hutchinson& SE Sawyer,*	**:**	Computer and Information System
3.	*Taylor, G* GCSE	**:**	Computer Studies

Course Code: ENG-106	Course Title: English	Credit: 2.0

1. **Grammar:** Tenses; Articles; Prepositions; Subjects verb agreement; Clauses; Conditionals; Word Classes; Transformation of sentences; Active-passive transformations; Report speech.
2. **Phonetics:** How to use a dictionary; IPA symbols; Word transcriptions; Intonation and stress.

3. **Vocabulary Building:** Correct and precise diction; Affixes; Idiomatic expression; Level of appropriateness; Colloquial and informal; Standard and formal.
4. **Developing Writing and Reading Skills:** Sentences; Sentences variety; Generating sentences; Sentence clarity and correctness; Linking sentences; Paragraphs; Paragraph with specific details and examples; Essay structures; Thesis sentences; Writing good introduction and conclusions; Letter writing; Strategies of reading; Skimming; Scanning; Predicting, analyzing and interpreting variety of texts type.
5. **Listening and Note Taking:** Listening to recorded texts and class lectures and learning to take useful notes based on the listening.
6. **Developing Spoken Skills.**

Books Recommended:			
	Authors		**Books**
1.	*Thomas and Martin*	**:**	A practical English Grammar
2.	*Thomson and Martinet,*	**:**	Cobuild English Grammar
3.	*Leech &Svartvick*	**:**	A Communicative of English
4.	*Michael Swan*	**:**	Practical English Usage, Oxford University

Course Code: MATH- 107	Course Title: Differential & Integral Calculus	Credit: 3.0

1. **Functions:** Domain; Range; Functions and Graphs of Functions; Limits; Continuity.
2. **Ordinary Differentiation:** Differentiability; Differentiation; Indeterminate form; Successive differentiation and Leibnitz theorem.
3. **Expansions of Functions:** Rolle's Theorem; Mean value theorem; Taylor's and Maclaurin's formulae.
4. **Maxima and Minima of Functions of One Variable.**
5. **Partial Differentiation:** Euler's Theorem; Tangents and Normals**.**
6. **Asymptotes.**
7. **Indefinite Integral:** Method of substitutions; Integration by parts; Special trigonometric functions and rational fractions.
8. **Definite Integrals:** Fundamental theorem; General properties; Evaluations of definite integrals and reduction formulae.
9. **Multiple Integrals:** Determination of lengths, areas and volumes.

Books Recommended:			
	Authors		**Books**
1.	*F. Ayres*	**:**	Calculus
2.	*BC. Das& BN. Mukherjee*	**:**	Differential Calculus
3.	*BC. Das& BN. Mukherjee*	**:**	Integral Calculus
4.	*Edwards*	**:**	Differential Calculus
5.	*RE. Williamson*	**:**	Integral Calculus
6.	*Muhammad & Bhattacherjee*	**:**	Differential Calculus
7.	*Muhammad & Bhattacherjee*	**:**	Integral Calculus

Course Code: PHY-108	Course Title: Physics Lab-I	Credit: 1.5

1. To determine the moment of inertia of a fly wheel about its axis of rotation.
2. To determine the rigidity modulus of a short wire by dynamical method.
3. To determine spring constant and effective mass of a spiral spring and hence to calculate the rigidity modulus of the material of the spring.
4. To determine the surface tension of water by capillary tube method
5. To determine the value of acceleration due to gravity, g by means of a compound pendulum.
6. To determine the acceleration due to gravity g by kater's pendulum.
7. To determine the specific resistance of a wire using a meter bridge.
8. Determination of the unknown resistance and verification of the laws of combination of resistance using a P.O box.
9. To determine the internal resistance of a cell by potentiometer.

Books Recommended:			
	Authors		**Books**
1.	*Giasuddin Ahmad and, Md. Shahabuddin*	**:**	Practical Physics for Degree Students
2.	*C.L. Arora*	**:**	B.Sc. Practical Physics
3.	*Harnam Singh*	**:**	B.Sc. Practical Physics
4.	*Kalimuddin*	**:**	B.Sc. Practical Physics

Course Code: PHY-109	Course Title: Viva	Credit:1.0

2nd Semester

Course Code: PHY-201	Course Title: Waves & Oscillation	Credit: 3.0

1. **Oscillations:**
    a) Definition of Simple Harmonic Motion (SHM); Mass-spring system; Energy conservation in mass energy system.
    b) Damping forces; Types of damping; Logarithmic decrement; Relaxation time and quality factor (Q); Electromagnetic damping; Damped SHM: under damped, over damped and Critical damped.
    c) Forced oscillations; Resonance: examples of resonance.
    d) Combination of simple harmonic oscillators: Lissajous' figures.
    e) Energy in a harmonic oscillator; Physical and torsional pendulum.
2. **Coupled Oscillators and Normal Modes of Continuous System:** Coupled oscillators; Normal coordinates and normal modes; Forced vibration of a coupled oscillator; N-coupled oscillator wave motion as a limit of coupled oscillation.
3. **Fundamentals of Waves:** Waves in elastic media; Types of waves; Wave generation; Wave equation and solution; Energy, power and speed of traveling waves; Transverse and longitudinal waves; amplitudes and phase; phase velocity; wave fronts; Plane and spherical waves; Mathematical representation of plane and spherical waves; Introduction to some wave phenomena in physics.
4. **Superposition of Periodic Motions:** Principle of superposition; Superimposed vibration of equal and different frequencies; Stationary waves; Beats; Huygens principles.

5. **Sound Waves and Acoustics:** Sources; Propagation and speed of sound in fluid and solid media; Musical sound; Doppler's effect; Infrasonic and ultrasonic; Recording and reproduction of sound; General idea of acoustics.

Books Recommended:			
	Authors		**Books**
1.	*C.A. Coulson*	**:**	Waves
2.	*A.B. Wood*	**:**	A Text book of Sound
3.	*N.W. Molechlan*	**:**	Theory of Vibration
4.	*A. P. French*	**:**	Vibrations and Waves
5.	*BrijLal*		Waves and Oscillations

Course Code: PHY-202	**Course Title: Mathematical Physics-I**	**Credit: 3.0**

1. **Vector Analysis:** Applications of dot and cross products of vectors; Scalar triple product; Vector triple product; Ordinary derivatives of vectors; Space curves; Differentiation formulae; Partial derivatives of vectors; Differentials of vectors; The vector differential operator nabla (∇); Gradient; Divergence; Curl and their physical significance; Line integrals; Surface integrals; Volume integrals; Green's theorem in the plane; Stoke's theorem; Applications; frames of reference-rectangular; Spherical polar and cylindrical coordinates; Concept of curvilinear coordinates; Line arc length, surface and volume elements in different coordinates; div., curl and Laplacian in Cartesian, spherical polar and cylindrical polar coordinates.
2. **Techniques of Complex Variables:** Function of a complex variables; The Cauchy-Riemann relations; Power series in a complex variable; Elementary function; Multi valued

function and branch cuts; Jordan lemma; Singularities and zeros of complex functions. Complex integrals; Green's theorem; Cauchy's Theorem; Cauchy's integral formula and its expansion; Taylor and Laurent series; Residue theorems; Finding residues; Evaluation of definite integrals using the method of residue. Integrals of sinusoidal functions; infinite integrals.

3. **Elements of Tensor Algebra:** Definition of tensor; Importance of tensor in Physics; Rank, Covariant and contravariant tensors; Transformation of coordinates; Kronecker delta and Levi-Civita symbols; Einstein summation convention; Direct product; Symmetric and anti-symmetric tensors; Contraction; Tensor equations; Metric tensor and their determinants; General coordinate transformations and tensors.

Books Recommended:			
	Authors		Books
1.	*Spigel, Lipschutz & Spellman*	**:**	Vector Analysis
2.	*Harry Lass*	**:**	Vector and Tensor Analysis
3.	*Dr. B. S Rajput*	**:**	Mathematical Physics
4.	B D Gupta	**:**	Mathematical Physics
5.	*Spigel, Lipschutz, Schiller& Spellman*		Complex Variables

Course Code: PHY-203	Course Title: Heat & Thermodynamics	Credit: 3.0

1. **Temperature:** Principles of measurement and establishment of temperature scales; Gas Thermometer; Electrical Resistance Thermometer; Thermocouple.
2. **The Kinetic Theory of Gases**: Macroscopic versus microscopic properties; Brownian motion; Mean free path; Derivation of Maxwell-Boltzmann distribution; mean speed; most probable speed and r.m.s. speed; Deduction of the ideal gas equation; Equipartition of Energy. Degrees of freedom and specific heat: applications.
3. **Thermodynamics:**
   a) Zeroth law of thermodynamics: Thermal equilibrium and temperature scales; Concept of intensive and extensive variables.
   b) P-V diagrams; Isotherms and adiabatics; Equation of states; ideal gas Vs. real gases; Vander Waals equation; Critical parameters.
   c) First law of thermodynamics; Difference between heat and work; Internal energy; Reversible and irreversible process; Quasi static process; Calculation of work; Heat and internal energy in different process.
   d) Second law of thermodynamics; Heat engines; Efficiency of heat engines; Carnot cycle and Carnot's theorem; Absolute scale of temperature; The concept of entropy as a state function; Change of entropy in irreversible and cyclic process; Clausias and Kelvin statements of the second law. Entropy as a measure of microscopic states and the Boltzmann formula for entropy. Calculation of entropy via microscopic methods; Third law of thermodynamics.

e) Thermodynamic potentials: Enthalpy; Helmholtz and Gibbs free energies; Legendre transformation; Gibbs-Duhem equation; exact differential form and Maxwell relations; Heat capacities and other response function and theirrelations.

f) Applications: i) Cooling of gasses by free expansion and throttling (Joule-Thomson Process) ii) Adiabatic demagnetization ii) Thermoelectric phenomena: Seebeck, Peltier and Thompson effects.

g) Phase transitions: Classification of phase transitions; First order and second order phase transition and their examples; Clausius- Clapeyron equation; Chemical potential; Gibbs phase rule.

4. **Radiation:** Black body radiation; Thermodynamics of radiation; Stefan's law; Rayleigh-Jeans law and ultraviolet catastrophe; Wien's displacement law, Planck's distribution law for blackbody radiation and quantum hypothesis.

Books Recommended:			
	Authors		**Books**
1.	*Hossain, T*	**:**	Text Book on Heat
2.	*Saha, MN and Srivastava, BK*	**:**	A Treatise on Heat
3.	*Zemansky, MW*	**:**	Heat and Thermodynamics
4.	*Miah, W*	**:**	Fundamentals of Thermodynamics

Course Code: CHEM-204	Course Title: Inorganic and Organic Chemistry	Credit: 2.0

1. **Atomic Structure:** Elementary ideas of atomic structure; Electronic configuration of Elements.
2. **Periodic Classification of Elements**: Modern periodic table; Periodic classification of elements; Correlation of periodic classification with electronic configuration; Investigation on some periodic properties; Atomic radius; Ionic radius; Covalent radius; Ionization potential; Electron affinity; Electro negativity.
3. **Group Study of Elements:** Alkali metals; Alkaline earth metals; Halogens; Inert gases and transition elements.
4. **Chemical Bonds:** Elementary different types of chemical bonding; Concept of hybridization; Molecular orbitals; Bond length and binding strength.
5. **Aliphatic Compounds:** Nomenclature of organic compounds; Preparation and properties of alcohols; Halides; Aldehydes; Ketones and carboxylic acids.
6. **Aromatic Compound:** Aromaticity; Orientations; Preparations and properties of benzene, phenol, nitrobenzene and aniline; Alicyclic and heterocyclic compounds.

Books Recommended:			
	Authors		**Books**
1.	*S.Z. Haider*	**:**	Modern Inorganic Chemistry
2.	*T. Moeller*	**:**	Modern Inorganic Chemistry
3.	*E. Gilreath*	**:**	Fundamental Concepts of Inorganic Chemistry
4.	*D.K. Seberra*	**:**	Electronic Structure and Chemical Bonding

5.	*M. Ahmed & A. Jabbar*	**:**	Organic Chemistry
6.	*I.M. Finer*	**:**	Organic Chemistry
7.	*B.S. Bahl and A. Bahl*	**:**	Advanced Organic Chemistry

Course Code: CHEM-205	**Course Title: Chemistry Lab.**	**Credit: 1.5**

Laboratory works based on **PHY-204.**

Course Code: STAT-206	**Course Title: Statistics**	**Credit: 3.0**

1. **Introduction:** Origin and Historical development of Statistics, Meaning of Statistics, Uses of Statistics in Physics.
2. **Some important topics:** Population and Sample; Types of Variable; Scales of Measurement; Types of Data; Descriptive and Inferential statistics; Sources of statistical data; Primary and Secondary sources; Data collection tools; Sampling and Sample Survey.
3. **Processing and Presentation of Data:** Editing; Coding; Tabulation; Different types of tables; Frequency distribution; Graphical presentation of data; Details of different types of graphs and charts with their relative merits and dements.
4. **Characteristics of Statistical Data:** Measures of location or Central tendency; Purposes and situations of Central tendency; Measure of Dispersion; Purposes and situations of Dispersion; Some elementary Theorem and Examples.

5. **Correlation Analysis:** Bivariate data; Scatter diagram; Simple correlation; Rank correlation; Correlation ratio; Multiple and partial correlations.
6. **Regression Analysis:** Basic concept and assumption of regression; Regression model; Estimation of parameters (OLS method) in regression model; Properties of estimators.
7. **Estimation and Test of Hypothesis:** Estimate; Estimator; Estimation; Level of Significance; Type-I and Type-II error; P- value; Z-test; T-test; Chi-square test.
8. **Elements of Probability:** Sample space; Event; Experiment; Random experiment; Random Variable; Discrete and Continuous random variables; Different approaches of defining probability; Probability distribution.
9. **Some Basic Distributions:** Discrete and Continuous Probability distribution**;** Bernoulli trial; Bernoulli distribution; Binomial distribution; Poisson distribution; Normal Distribution.

Books Recommended:			
	Authors		**Books**
1.	*M.K Roy, J. C Paul*	**:**	Business statistics
2.	*Mason, Robert. De. ,Lind, Douglas A. Marshal, William G.,*	**:**	Statistical Techniques in Business and Economies- 16thEdition, McGraw-hill.
3	*M. Nurul Islam*	**:**	An introduction to Statistics and Probability, 4th edition.
4.	*A.J.B. Anderson*	**:**	Interpreting Data
5.	*M.G. Bulm r*	**:**	The Elements of Probability Theory
6.	*W. Feller*	**:**	Introduction Statistics
7.	*U. Yule and Kendal*	**:**	Introduction to Theory of Statistics
8.	*D.V. Lindley*	**:**	Introduction to Probability and Statistics
9.	*M.G. Mostafa*	**:**	Method of Statistics

Course Code: MATH-207	Course Title: Linear Algebra	Credit: 2.0

1. **Vectors in R^n and C^n:** Review of geometric vectors in R^2 and R^3 space; Vectors in R^n and C^n . Inner product; Norm and distance in R^n and C^n.
2. **Matrices and Determinants:** Notion of matrix, types of matrices, matrix operations, laws of matrix algebra; Determinant and its Properties; Minors; Cofactors; expansion and evaluation of determinants; Elementary row and column operations and row-reduced echelon matrices; Invertible matrices; Block matrices.
3. **System of Linear Equations:** linear equations; System of linear equations (homogeneous and non-homogeneous) and their solutions; Application of matrices and determinants for solving system of linear equations.
4. **Vector Spaces:** Notions of groups and fields; Abstract vector space, subspace; Sum and direct sum of subspaces; Linear independence of vectors; Basis and dimension of vector spaces; Row and column space of a matrix; rank of matrices; Solution spaces of systems of linear equations.
5. **Linear Transformations:** Linear transformations; Kernel and image of a linear transformation and their properties; Matrix representation of linear transformations; Change of bases.
6. **Eigenvalues and Eigenvectors:** Eigenvalues and eigenvectors; Diagonalization; Cayley-Hamilton theorem and its applications.

Books Recommended:			
	Authors		**Books**
1.	*Bamside and Pantion*	**:**	Theory of Equations
2.	*Bemard and Child*	**:**	Higher Algebra
3.	*Hall, HS and Knight, SR*	**:**	Higher Algebra

Course Code: PHY-208	**Course Title: Physics Lab-II**	**Credit: 1.5**

1. To determine horizontal component of the earth magnetic field and the magnetic moment of a magnet by employing magnetometer.

2. To find the variation of the frequency of a tuning fork with the length of a sonometer (*n-l* curve) under given tension and hence to determine the unknown frequency of a tuning fork.

3. To determine the specific heat of a liquid by the method of cooling.

4. To determine the coefficient of thermal conductivity of a metal using Searle's apparatus.

5. To determine the thermal conductivity of a bad conductor by Lee's and Charlton's method.

6. To compare the *e.m.f* of two cells with a potentiometer.

7. To determine the resistance of a galvanometer by half deflection method.

8. To determine the temperature coefficient of the resistance of the material of a wire.

9. To determine the pressure co-efficient of a gas at constant volume by constant volume air thermometer.

10. To compare the magnetic moments of two magnets.

Books Recommended:			
	Authors		**Books**
1.	*Giasuddin Ahmad and, Md. Shahabuddin*	**:**	Practical Physics for Degree Students
2.	*C.L. Arora*	**:**	B.Sc. Practical Physics
3.	*Harnam Singh*	**:**	B.Sc. Practical Physics
4.	*Kalimuddin*	**:**	B.Sc. Practical Physics

Course Code: PHY-209	**Course Title: Viva**	**Credit: 1.0**

3rd Semester

Course Code: PHY-301	**Course Title: Optics-I**	**Credit: 3.0**

1. **Propagation of Light:** Light and electromagnetic spectrum, Velocity of light in Vacuum in terms of $\mathcal{E}_0$ and μ_0; Super luminal light; Poynting vector and intensity of light; Huygen's principle, Fermat's principle; coherence properties of ordinary and laser light.
2. **Reflection and Refraction of light:** Concept of reflection and Refraction; Reflection and Refraction of spherical surfaces; Refraction through lenses; Equivalent lens; Cardinal points.
3. **Interference:** Principle of Superposition; Conditions of Interference; Analytical treatment; Young's experiment; Fresnel biprism; Newton's rings; Michelson Interferometer; Multiple beam Interference; Fabry-Perot Interferometer.

4. **Diffraction:** Fresnel& Fraunhofer diffraction; Diffraction-single slit and double slit; Multiple slits diffraction phenomena; Diffraction gratings; Crystal diffraction; Bragg's law.
5. **Polarization:** Definition; Plane, circular and elliptic polarization; Polarization by reflection; Brewster's law; Malus law; Optical activity; Birefringence; Optical axis; Full-wave, half-wave and quarter-wave plates; Nicol and Wollaston prisms; Dispersion; Cauchy and Sellmeir formula; Polarization by scattering; Rayleigh scattering; Scattering phenomena in the atmosphere; Faraday, Kerr and Pockels effects; polarization by double refraction.

Books Recommended:			
	Authors		**Books**
1.	*R.S. Longhurst*	**:**	Geometrical & Physical Optics
2.	*D. Halliday, R. Resnick, K.S. Krane*	**:**	Physics (Vol.-2)
3.	*O. Svelto and D.O. Hanna*	**:**	Principle of Lasers
4.	*F.A Jenkin and H.E. White*	**:**	Fundamentals of Optics
5.	*G.B. Goodhar*	**:**	Introduction to Optics
6.	*A. Ghatak*	**:**	Optics

Course Code: PHY-302	**Course Title: Electronics-I**	**Credit: 3.0**

1. **Circuit Analysis:** Constant current **a**nd constant voltage sources; Network theorem: Nortan's theorem, Thevenin's theorem, Maximum power transfer theorem, Superposition theorem; Filters.

2. **Semiconductor Diode:** Semiconductor; Energy band description of semiconductors; Effect of temperature on semiconductors; Hole current; Different types of semiconductors; Majority and minority carriers; p-n junction; Properties of p-n junction; Semiconductor diode; Forward and reverse bias, I-V curve, Diode equation, Equivalent circuits; DC and AC Resistances; Load line analysis of a diode circuit, Breakdown: Avalanches and Zener mechanism. Special Diode: Zener diode, LED and Tunnel diode, Photodiode; Semiconductor diode rectifiers; Half-wave rectifier; Full-wave rectifier; Efficiency of half-wave and full-wave rectifier; Ripple voltage and factor; PIV rating; Capacitor smoothing; Voltage stabilization; Zener diode as a voltage stabilizer.
3. **BJT:** Construction and operation; amplifying action; CB, CE, CC configuration; CB and CE characteristics; active, cut-off, and saturation region; Alpha and beta; DC load line, Operating point or Q-point, Active region for linear application; Leakage current in a transistor, Thermal runway of a transistor; Transistor as a switch; Different methods for transistor biasing; Fixed bias, Collector feedback, and voltage divider bias; emitter feedback for bias stabilization; AC load line.
4. **FET**: JFET configuration; operation and characteristics; MOSFET construction; operation and characteristics; biasing of FETs; DC load line; Common source JFET amplifier; ; Switching circuits using FETs; Introduction to CMOS.
5. **Equivalent models and circuits:** modeling and equivalent circuit of BJTs and FETs. Parameters models of transistor: Ebers moll model, Z, Y and h equivalent model. Classification of amplifiers; Single stage and multi-stage transistor amplifiers; R-C coupled and transformer coupled transistor amplifiers; Power amplifier: class A, class B and

class C amplifiers; Push-pull amplifier, Tuned amplifier; distortions in amplifiers; Variations in amplifier gain with frequency; stray capacitance and miller effect capacitance; multistage frequency effects.

Books Recommended:			
	Authors		**Books**
1.	*A.P. Malvino*	**:**	Electronic Principles
2.	*R.L. Boylestad and L. Nashelsky*	**:**	Electronic Devices and Circuit Theory
3.	*B. Grob*	**:**	Basic Electronics
4.	*V.K. Mehta*	**:**	Principles of Electronics
5.	*B. L. Theraja*	**:**	Basic Electronics Solid State

Course Code: PHY-303	**Course Title: Classical Mechanics**	**Credit: 3.0**

1. **Lagrangian Formulation:** Generalized Coordinates; Constraints; Degrees of freedom; D'Alembert's Principle and Langrange's Equations; Some Techniques of the Calculus of Variations; Hamilton's Principle and Lagrange's Equations; Conservation Theorems.
2. **The Two-Body Central Force Problem:** Two Body Central Force Problem Reduction to Equivalent One-Body Problem; Classification of Orbits; Differential Equation for the Orbit; Inverse Square Law of Force; Scattering in a Central Force Field; Scattering Problem.
3. **Rigid Bodies:** Kinematics and dynamics of rigid bodies; Independent co-ordinates: Euler's angles; Force free motion; Euler's equation of motion; Symmetrical top.

4. **Hamilton's Equation of Motion:** Legendre transformation and Hamilton's equations; Conservation theorem; Derivation from variational principle; Principle of least action and its applications.
5. **Canonical Transformations:** Equations of canonical transformation; Integral invariant of Poincare; Lagrange and Poisson brackets.

Books Recommended:			
	Authors		**Books**
1.	*G. Goldstein*	**:**	Classical Mechanics
2.	*N.C. Rana & P.S. Joag*	**:**	Classical Mechanics
3.	*S.L. Gupta, H.V Sharma & V Kumar*	**:**	Classical Mechanics
4.	*K.C. Gupta*	**:**	Mechanics of Particle & Rigid Bodies

Course Code: PHY-304	**Course Title: Mathematical Physics-II**	**Credit: 3.0**

1. **Matrices**: Different types of matrices and their definition, Matrix equivalence, The adjoint and innerse of a matrix, Orthogonal and unitary matrices, Vector spaces linear equations, Similarity transformation, Characteristic roots and nector higonalization of matrices.
2. **Special function:** Gamma and Beta functions; Bessell's Functions; Legendre Function; Legendre Hermit; Legendre Polynomials; Dirac Delta Function; Hypergeometric functions; Fourier and Laplace transforms.
3. **Differential Equations:** Power series solutions; Solution of the differential equations by the method of separation of

variables, Solution of Laplace's equation in spherical polar and cylindrical coordinates.

4. **Fourier Series:** Fourier series; the Dirichlet conditions; The Fourier coefficients; Symmetry consideration; Discontinuous function; Non-periodic function; Integration and differentiation; Application of Fourier series; Complex Fourier series; Parseval's theorem.

Books Recommended:			
	Authors/ Publisher		**Books**
1.	*Schaum's Outline Series; McGraw-Hill International*	**:**	*Theory of Matrices*
2.	*H. T. M. Piaggio*	**:**	*An Elementary Treatise on Differential Equations and their Applications*
3.	*Schaum's Outline Series; McGraw-Hill International*	**:**	*Differential Equations*
4.	*Bukov*	**:**	*Mathematics for Physics*
5.	*B. D. Gupta*	**:**	*Mathematical Physics*
6.	*B. S. Rajput and Yog Prokash*	**:**	*Mathematical Physics*

Course Code: MATH-305	**Course Title: Co-ordinate Geometry**	**Credit: 2.0**

Transformation of co-ordinates axes and its uses, Equation of conics and its reduction to standard forms, Pair of straight lines, Homogeneous equations of second degree, Angle between a pair of straight lines, Pair of lines joining the origin to the point of

intersection of two given curves and circles, System of circles, Orthogonal circles, Radical axis, radical center, properties of radical axes, coaxial circles and limiting points,
Equation of parabola, Equation of ellipse and Equation of hyperbola in Cartesian and polar co-ordinates, Tangents and normal, pair of tangents, Chord of contact, Chord in terms of its middle points, Pole and polar parametric co-ordinates, Diameters, Conjugate diameters and their properties, Director circles and asymptotes.

Books Recommended:			
	Authors		**Books**
1.	*Bell, J.T*	**:**	*Solid Geometry*
2.	*Smith*	**:**	*Co-ordinate Geometry*
3.	*Chaki, M.C*	**:**	*Co-ordinate Geometry*
4.	*Loney, S.L*	**:**	*Co-ordinate Geometry*
5.	*Askwith*	**:**	*Co-ordinate Geometry*
6.	*Rahman & Bhattacharjee*	**:**	*Co-ordinate Geometry*

Course Code: PHY-306	**Course Title: Physics Lab-III**	**Credit: 1.5**

1. To determine the focal length and hence the power of a concave lens using an auxiliary convex lens.
2. To determine the refractive index of a liquid by pin method using a plane mirror and a convex lens.
3. To determine by boys' method (a) The radius of curvature of a lens and (b) the refractive index of the material of the lens.
4. To Compare the *e.m.f* of two cells with potentiometer
5. To determine the resistance of a galvanometer by half deflection method.

6. To determine the resistance per unit length of meter bridge wire.
7. To determine the angle of a prism (by rotation of the telescope).

Books Recommended:			
	Authors		**Books**
1.	*Giasuddin Ahmad and, Md. Shahabuddin*	**:**	Practical Physics for Degree Students
2.	*C.L. Arora*	**:**	B.Sc. Practical Physics
3.	*Harnam Singh*	**:**	B.Sc. Practical Physics
4.	*Kalimuddin*	**:**	B.Sc. Practical Physics

Course Code: PHY-307	**Course Title: Viva**	**Credit: 1.0**

4th Semester

Course Code: PHY-401	**Course Title: Atomic and Molecular Physics**	**Credit: 3.0**

1. **Atomic Structure:** Rutherford scattering experiment, Atomic spectra, Bohr atom model, Energy levels, Hydrogen atomic spectra, Atomic excitation, The Franck-Hertz Experiment, The correspondence principle.
2. **Particle Properties of Ways:** Quantum theory of radiation, Photoelectric Effect, Einstein's quantum theory of light and Einstein's photoelectric equation, Compton effect, Pair production and Pair annihilation.
3. **X-Ray:** Production and Properties of x-rays, Continuous and Characteristic X-ray diffraction of X-ray, Bragg's Law, X-ray spectrum, Moseley's Law, Absorption of X-ray.

4. **Many-Electro Atoms:** Electron spin, Sterm-Gerlach experiment, Pauli Exclusion Principle, Quantum numbers, Electronic configuration of the atom, Vector atom model, coupling schemes, Hund's rule.
5. **Multiple structure:** Explaining the fine structure, $H_\alpha$line of Hydrogen spectra and sodium D lines, Zeeman Effect, Normal and anomalous Zeeman Effect, Zeeman splitting of sodium D_1 and D_2 lines, Paschen-Back effect, Stark effect.
6. **Molecular spectra:** Rotational energy levels, Rotations about the Bond axis, Rotational spectra, Vibrational energy levels, Vibrational spectra, Selection rule, Electronic spectrum of molecules, Raman Effect.
7. **Laser:** laser principle, Stimulated emission, Population inversion, Properties of Laser beam, Ruby and He-Ne lasers.

Books Recommended:			
	Authors		**Books**
1.	*Beiser, A.*	**:**	*Concepts of Modern Physics*
2.	*Beiser, A.*	**:**	*Perspective of Modern Physics*
3.	*Eisberg, R.M.*	**:**	*Fundamental of Modern Physics*
4.	*Enge, Wehr and Richards*	**:**	*Physics of the Atom*
5.	*Ohanian*	**:**	*Modern Physics*

Course Code: PHY-402	Course Title: Electronics-II	Credit: 3.0

1. **Feedback and Oscillator Circuits:** Feedback: Principles; Characteristics; Current and voltage feedback amplifiers; Positive feedback; Negative feedbacks; forms of negative feedback; advantages of negative feedback; Oscillator: Condition for sustained oscillation; Barkhausen criterion for oscillation; Phase-Shift; Wein-Bridge; Hartley, Colpitt's and Crystal Oscillators, negative resistance oscillator.
2. **Operational Amplifiers (OP-AMP):** Basic concept on difference amplifier as the input stage of an amplifier; differential and common mode operation; common mode rejection ratio; the ideal op-amp; the practical op-amp; frequency response of an op-amp; gain bandwidth product; slew rate; offset voltage and currents. Linear application of op-amp; inverting and non-inverting amplifier: voltage gain; adder, subtractor, comparator, integrator, differentiator, active filters, Schmidt trigger; application in millivolt meter and current meter.
3. **Multi-vibrator and Switching Circuit:** Astable with BJT, JFET, and timer ICs. Monostable with BJT and timer IC, Schmitt trigger with BJT, Astable, monostable, bistable, sine-wave oscillator with op-amp. Triangular wave generator, saw-tooth wave generator, voltage-controlled oscillator, blocking oscillator, voltage time base generator, exponential sweep circuit, the miller circuit and the bootstrap circuit, current time base generator, trapezoidal waveform, sweep circuit for TV receiver.
4. **Voltage Regulator**: Series voltage regulation with feedback using transistor and op-amp, load and source regulation, current limiting, IC regulators, switched mode power supply.

5. **Radio Transmitter and Receiver:** Types of modulation; AM modulation; Modulation factor; Analysis of amplitude modulated wave; Demodulation; Linear diode detection; Linear envelop detection; Discriminator circuit. Radio Transmitter and Receiver: Transmitter: Classification of radio transmitter; AM transmitter; FM transmitter; Phase modulated type FM transmitter; Reactance tube FM transmitter; Armstrong FM transmitter; Receiver classification: AM receiver; TRF receiver; Super heterodyne FM receiver; AVC and AFC system.
6. **Power Electronics:** SCR: Construction; V-I characteristics; Applications of SCR; UJT: Construction; V-I characteristics; Applications of UJT; Triac: Construction; Characteristics; Diac: Operation; Characteristics; Application of Diac.

Books Recommended:			
	Authors		**Books**
1.	*James J. Brophy*	**:**	Basic Electronics for Scientists
2.	*R. L.Boylestad, L. Nashelsky*	**:**	Electronic Devices & Circuit Theory
3.	*J. Millman & A. Grabel*	**:**	Microelectronics
4.	*V. K. Mehta*	**:**	Principle of Electronics
5.	*G. K. Mithal*	**:**	Electronic Devices & Circuit
6.	*Dr. S. L. Gupta and Dr.V. Kumar*	**:**	Hand Book of Electronics

Course Code: PHY-403	**Course Title: Special & General Relativity**	**Credit: 3.0**

1. **Special Theory of Relativity:** Inertial frames of reference; Michelson Morley Experiment; Galilean transformation; Lorentz transformation; Postulates of the special theory of relativity; Four vectors; Length contraction; Time dilation; Twin paradox; Newtonian mechanics; Relativistic mass; Relativity of simultaneity; Proper time; Velocity addition; LIGO.
2. **Relativistic Mechanics:** Equivalence of mass and energy; Mass and momentum; Relativistic energy; Momentum energy four vector; Relativistic force law; Relativistic Lagrangian.
3. **General Relativity:** Postulates of General Relativity; Photons and Gravity; Doppler effect and Gravitational red shift; Principle of Equivalence; Principle of General Relativity; Motion of a particle in a Gravitational field; The constant Gravitational field.

4. **Field Equation:** Energy-Momentum tensor; Maxwell's field Equation; Schwarzschild solution; Experimental tests of general relativity.

Books Recommended:			
	Authors		**Books**
1.	*D'Inverno, R*	**:**	*Introducing Einstein's Relativity*
2.	*Resnick, R*	**:**	*Introduction to Special Relativity*
3.	*Bergmann, P G*	**:**	*Introduction to the Theory of Relativity*

Course Code: PHY-404	**Course Title: Optics-II**	**Credit: 3.0**

1. **Defect of Images and Optical Instruments:** Aberrations; Spherical aberration at a single surface and in lens reducing spherical operations; Coma; Astigmatism; Distortion; Chromatic aberrations; Achromatic doublets; Microscope and telescope.
2. **Fiber Optics:** Basics concepts; Principle of light propagation through optical fibers; Numerical aperture; Fiber bundles; Types of fiber, Step-index and grad index fibers; Multimode and single mode fiber; Optical fiber communications.
3. **Fourier Optics:** Fourier transforms in two dimensions; Inverse transforms; Dirac delta function; Optical application; Convolution and convolution theorem; Fourier methods in diffraction theory; Lens as a Fourier transformer; Spectra and correlation; Interpretation of Parseval's formula; Auto-correlation and cross-correlation; Wiener-Khintehine theorem.

4. **Holography:** Diffraction from apertures and edges; Production of holograms; LASER properties; Emission and absorption coherence of radiation.
5. **Dispersion and Scattering:** Normal and anomalous dispersion; Cauchy and Sellmeier equation; Rayleigh scattering; The blueness of sky and the red at the sunset and sunrise; Mie scattering qualitative.

Books Recommended:			
	Authors		**Books**
1.	*R.S. Longhurst*	**:**	Geometrical & Physical Optics
2.	*D. Halliday, R. Resnick, K.S. Krane*	**:**	Physics (Vol.-2)
3.	*O. Svelto and D.O. Hanna*	**:**	Principle of Lasers
4.	*F.A Jenkin and H.E. White*	**:**	Fundamentals of Optics
5.	*G.B. Goodhar*	**:**	Introduction to Optics
6.	*A. Ghatak*	**:**	Optics

Course Code: PHY-405	**Course Title: Computer Programming**	**Credit: 2.0**

1. **Elements of Computer Structures and Programming Languages:** Different type of Computer Languages; Principles of programming; Structured programming concepts; Programming algorithms and flow charts construction; Introduction of C programming language; Basic structure of C program.

2. Writing, Debugging and Running programs using C; Variables; Arithmetic expressions; Data types; Operators and expressions; Character and Logical Data; Control flow; Loops and Logical Expressions; Functions and program structures; Pointers and arrays; Structures; Input/output systems in C; File Processing, Applications to Various Statistical and Physical Problems; Introduction to Simple structures in C++, Introduction to object oriented programming using C++ .

Books Recommended:			
	Authors		**Books**
1.	*E. Balagurusamy*	**:**	Programming in ANSI C
2.	*Kerighan and Ritchie*	**:**	The C Programming Language
3.	*H. Schildt*	**:**	Mastering Turbo C/C + +

Course Code: PHY-406	**Course Title: Computer Programming lab.**	**Credit: 1.5**

Students will complete at least three projects with proper documentation as assigned by teacher, based on course.

Course Code MATH-407	**Course Title: Numerical Analysis**	**Credit:2.0**

1. **Solution of Equation in one Variable:** Bisection algorithm, Method of false position, Fixed point iteration, Newton-Raphson method, Error Analysis for iterative method, Accelerating limit of convergence.

2. **Interpolation and Polynomial Approximation:** Taylor polynomials, Interpolation and Lagrange polynomial, Iterated interpolation, Extrapolation.
3. **Differentiation and Integration:** Numerical differentiation, Richardson's extrapolation, Elements of Numerical Integration: Trapezoidal rule, Simpson's 1/3 Rule, Adaptive quadrature method, Romberg's integration, Gaussian quadrature.
4. **Solutions of linear systems:** Gaussian elimination and backward substitution, pivoting strategies, LU decomposition method.

Books Recommended:			
	Authors		**Books**
1.	S. S. Sastry	**:**	Introductory Methods to Numerical Analysis
2.	E. Balagurusamy	**:**	Numerical Methods.
3.	R. L. Burden & J. D.	**:**	Numerical Analysis.
4.	*Kalimuddin* M. A. Celia & W. G. Gray,	**:**	Numerical Methods for Differential Equations.
5.	L. W. Johson & R. D.	**:**	Numerical Analysis.

Course Code: PHY-408	**Course Title: Physics Lab.- IV**	**Credit: 1.5**

1. To determine the radius of curvature of a lens by Newton's rings.
2. To determine the Wavelengths of various spectral lines by a spectrometer using a plane diffraction grating.
3. To calibrate a polarimeter and hence to determine the specific rotation of a sugar solution by means of a polarimeter.

4. To calibrate an ammeter by potential drop method with the help of a potentiometer.
5. To determine the electro-chemical equivalent of copper by using an ammeter and copper voltmeter.
6. To determine the value of J. the mechanical equivalent of heat, by electrical method.
7. To determine a high resistance by the method of deflection.
8. Determination of dispersive power of a plane diffraction grating.

Books Recommended:			
	Authors		**Books**
1.	*Giasuddin Ahmad and, Md. Shahabuddin*	**:**	Practical Physics for Degree Students
2.	*C.L. Arora*	**:**	B.Sc. Practical Physics
3.	*Harnam Singh*	**:**	B.Sc. Practical Physics
4.	*Kalimuddin*	**:**	B.Sc. Practical Physics

Course Code: PHY-409	**Course Title: Viva**	**Credit: 1.0**

5th Semester

Course Code: PHY-501	Course Title: Nuclear Physics- I	Credit: 3.0

1. **Nuclear Properties:** Constituents of Nuclei; Nuclear charge, size and density; Mass defect; Binding energy; Semi empirical mass formula; Nuclear force; Angular momentum; Spin; Parity and Symmetry; Magnetic dipole moment and electric moments.
2. **Radioactivity:** Stable and unstable nuclei; Natural and artificial radioactivity; Radioactive decay law; Half-life; Mean life; Successive radioactive transformations; Secular and transient equilibrium; Radioactive series; Uses of radioisotopes; Radioactive dating.
3. **Alpha, Beta and Gamma Emissions:** Alpha instability; Fine structure; Long range alpha particles; Theory of alpha decay; Beta decay and its energy measurement; Conservation of energy and momentum in Beta decay; Neutrino hypothesis; Orbital electron capture; Positron Emission; Gamma Decay; Mean lives for Gamma emission; Internal conversion.
4. **Stopping and detecting of Nuclear Radiation:** Ionization; Multiple scattering; Stopping power; Energy loss of electron and other charged particles; Pair Production; Pair annihilation; Radiation length.
5. **Nuclear reaction, Fission and Fusion:** Nuclear reaction and chemical reaction; Reaction dynamics; Q-value and threshold energy; Neutron and neutron flux; Fission process; Energy release in Fission; Chain reaction; Nuclear Fusion; Thermonuclear reaction in stars.
6. **Nuclear Detectors and particle accelerators:** Van de Graff accelerator; Cyclotron; Betatron; Ionization chambers;

Proportional counter and gm counter; Gas Filled counter; Solid- state counter; Scintillation counter; Neutron detection.

Books Recommended:			
	Authors		**Books**
1.	*Burcham, WE*	**:**	*Nuclear Physics*
2.	*Enge, HA*	**:**	*Introduction to Nuclear Physics*
3.	*Krane, K*	**:**	*Introductory Nuclear Physics*
4.	*Kaplan, I*	**:**	*Nuclear Physics*
5.	*Wong, SSM*	**:**	*Introduction to Nuclear Physics*
6.	*Smith, CMH*	**:**	*Text Book of Nuclear Physics*
7.	*Cohen, BL*	**:**	*Concepts of Nuclear Physics*
8.	*Islam, AKMA & Islam, MA*	**:**	*Nucleo Padartha Vigan (Bangla)*
9.	*Islam, GS*	**:**	*Paramanbik Ebong Nucleo Padarthabijan, Vol.II*
10.	*Evans*	**:**	*Atomic Nucleus*
11.	*Meyerhof, WE*	**:**	Elementary Nuclear Physics
12.	*Beiser*	**:**	*A Concepts of Modern Physics*

Course Code: PHY-502	Course Title: Quantum Mechanics-I	Credit: 3.0

1. **Origin of Quantum Mechanics:** Shortcomings of classical theory and origin of quantum physics; Quantum theory of radiation and photons; Photoelectric effect; Compton effect; Problems of the Bohr model; Wilson-Somerfield quantum conditions; Quantization of physical quantities; Basic postulates of quantum mechanics.
2. **Wave Nature of Matter:** Wave particle duality; De Broglie hypothesis; Wavelength and velocity; Phase and group velocity of matter wave; Wave packet; The Heisenberg uncertainty relation and applications.
3. **The Schrödinger Wave Equation:** The development of wave function and its interpretation; Normalization of wave function; Time dependent and time independent form of Schrödinger equation; Probability current density; Expectation values of dynamical variables; The Ehrenfest theorem.
4. **Fourier Techniques and Momentum Representation:** Fourier analysis of wave function; Fourier integral theorem; Parseval's formula; Coordinate and momentum representation of wave function; Significance; Schrödinger equation in momentum representation; Momentum wave function for free particle and particle in a box; Box normalization; Dirac delta normalization.

Books Recommended:			
	Authors		**Books**
1.	*K. Ziock*	**:**	Basic Quantum Mechanics
2.	*P. T. Matthews*	**:**	Introduction to Quantum Mechanics

3.	*S. L. Powell & D Crascmann*	**:**	Quantum Mechanics
4.	*L. Pauling & B Wilson*	**:**	Quantum Mechanics
5.	*V. Rojansky*	**:**	Introduction to Quantum Mechanics
6.	*Gupta, Kumar, Sharma*	**:**	Quantum Mechanics

Course Code: PHY-503	**Course Title: Solid State Physics - I**	**Credit: 3.0**

1. **Crystal System:** Crystalline and non-crystalline states; Unit cell; Bravais lattices; Miller indices; Simple crystal structures; Packing factor; Inter-planar spacing; Concept of reciprocal lattice; Brillion zones.
2. **Crystal Diffraction:** Bragg's law; Laue equation; Diffraction of X-rays by crystals; Atomic and crystal structure factors; Thermal vibrations; Temperature factor; Absorption
3. **Crystal Bindings:** Crystals of inert Gas; Ionic crystals; Binding energy and bulk modulus; Covalent; Metal and hydrogen bonded crystals.
4. **Crystal Bonding:** Interatomic forces and crystal bonding; Ionic crystal; Calculation of electrostatic energy; Madelung constant and bulk modulus; Covalent crystals; Crystals of inert gases; Van der Waals and repulsive interactions.
5. **Dynamics of Crystal Lattice:** Concept of phonon; Elastic vibration of a continuous medium; One-dimensional monoatomic and diatomic lattices; Theories of lattice; Specific heat: Einstein model and Debye model.

Books Recommended:			
	Authors		**Books**
1.	*C. Kittle*	**:**	Introduction to Solid State Physics
2.	*A. J. Dekker*	**:**	Solid State Physics
3.	*M. Omar Ali*	**:**	Elementary Solid State Physics
4.	*R. L.Singhal*	**:**	Introduction to Solid State Physics
5.	*Saxena, Gupta & Saxena*	**:**	Fundamental of Solid State Physics

Course Code: PHY-504	**Course Title: Electrodynamics-I**	**Credit: 2.0**

1. **Framework:**
   a) Review of Maxwell's equations in vacuum and in matter-integral and differential formulation; Boundary conditions at an interface.
   b) Vector and Scalar potentials; Gauge invariance; Lorentz and Coulomb gauge; Lorentz force in terms of potentials.
   c) Pointing's theorem and Energy-Momentum conservation for electromagnetic fields and charges.
2. **Boundary Value Problems in Electrostatics:**
   a) Poisson equations and Laplace equations; Uniqueness of the solution with Dirichlet of Neumann equation.
   b) Method of image charges; Solution of Laplace's equations in two and three dimensions in Cartesian, cylindrical and spherical coordinates; Associated Legendre polynomials and spherical harmonics.
   c) Multipole expansion of the potential due to a localized charge distribution; Dipole and quadrupole moments.
   d) Field inside dielectrics; Boundary value problems involving dielectrics.

3. **Propagation of Electromagnetic Waves in Isotropic Media:** Boundary conditions on the field vectors; Reflection and refraction of electromagnetic waves; Total internal reflection.
4. **Propagation of Electromagnetic Waves in Conducting Media:** Nature of metallic boundary conditions; Metallic reflection; Normal incidence; Oblique incidence; Propagation between parallel conducting plates; Propagation through ionized media; Wave guides; Cavity resonators.
5. **Propagation of Electromagnetic Waves in Crystalline Media:** Isotropic and anisotropic crystals; Light propagation in uniaxial crystals; Wave sun face; Internal and external conical refractions; Interference phenomenal in uniaxial and biaxial crystals; Isochromatic surface in uniaxial and biaxial crystals.

Books Recommended:			
	Authors		**Books**
1.	*Reitz J. R. and Milford, F. J.*	**:**	Foundations of Electromagnetic Theory
2.	*Penofsky, W. R. H and Philolps M.*	**:**	Classical Electricity and Magnetism
3.	*Corson D. R. and Lorrain P.*	**:**	Introduction to Electromagnetic Fields and Waves
4.	*Griffiths D. J.*	**:**	Introduction to Electrodynamics
5.	*Jackson J. D.*	**:**	Classical Electrodynamics
6.	*J.D. Fackson*	**:**	Classical Electrodynamics
7.	*N. Tralli*	**:**	Classical Electromagnetic Theory
8.	*R. Reifz & F. J. Milford*	**:**	Foundations of Electromagnetic Theory

9.	*D. R. Corson & Lorrain*	**:**	Introduction to Electromagnetic Fields and Waves

Course Code: PHY-505	**Course Title: Radiation and Statistical Mechanics**	**Credit: 3.0**

1. **Radiation:** Black body radiation; Emissive power and absorptive power; Kirchhoff's law; Stefan-Boltzmann law; Wien's displacement law; Rayleigh-Jeans formula; Planck's radiation law; Solar constant; Temperature of the sun; Application of radiation laws.
2. **Statistical System:** The scope of statistical physics; Postulates of classical statistical mechanics; Macroscopic and microscopic states; Thermodynamic functions and their equilibrium conditions.
3. **Ensembles**: Phase space; Lineville's theorem; Microcanonical Ensemble; Canonical Ensemble- its connection with thermodynamic parameters; Ideal monatomic gas; Harmonic oscillator; Specific heat of solids; Grand canonical ensemble; Maxwell velocity distribution and mean values.
4. **Statistical Distribution:** Maxwell-Boltzmann distribution; Bose-Einstein distribution and Planck's radiation law; Fermi-Dirac distribution and heat capacity of free electron gas.
5. **Quantum Statistics:** Need of quantum statistics; Indistinguishability and quantum statistics; Exchange symmetry of wave function; Exchange degeneracy; Average value and quantum statistics; The density matrix.
6. **Quantum Mechanical Gases:** Fermi gas; Fermi-Dirac distribution; Fermi energy; Degenerate Fermi system; Heat capacity of free electron gas; Bose gas; Bose-Einstein

distribution; Photon; Phonon; Bose-Einstein condensation; Thermodynamic properties of diatomic molecules; Nuclear spin effects in diatomic molecules.

Books Recommended:			
	Authors		**Books**
1.	*Reif, F.*	**:**	Fundamentals of Statistical and Thermal Physics
2.	*Landau, L. D. and Lifshitz E. M.*	**:**	Statistical Physics
3.	*Pathria, R. K.*	**:**	Statistical Mechanics
4.	*Gupta, Kumar & Sharma*	**:**	Statistical Physics
5.	*Brij Lal*	**:**	Thermal and Statistical Physics
6.	*S.L. Gupta*	**:**	Elementary Statistical Mechanics

Course Code: PHY-506	**Course Title: Digital Electronics**	**Credit: 3.0**

1. **Digital Electronics-an Overview**: Analog and digital world**;** advantages in error free communication and processing; Number system; Logic gates: definition, symbol and truth table; universal gates; Boolean algebra; SOP; POS; maxterm; minterm; algebraic simplification; simplifications using K-maps; don't care condition; Diode gate; DTL gate; TTL gate; comparison of important characteristics of IC logic families.
2. **Flip-flops and Related Devices:** NAND gate latch; Nor gate latch; Clock signal and clocked FF: S-C, J-K,D and T FFs; Master slave FFs; FF timing consideration; race around

condition; FF application: register; Counters: Design of synchronous and asynchronous counter; Modulo-N counters; Ring counters; Jonson counters; application of counters.

3. **Arithmetic Circuit:** Half adder and full adder; parallel binary adder; parallel adder ICs; BCD adder; subtract circuit; multiplier circuit; Typical arithmetic logic Unit(ALU).
4. **Decoding and Encoding**: Decoder, BCD to 7 segments decoder; BCD to decimal decoder; Encoder. Multiplexing and demultiplexing: Multiplexer and demultiplexers; applications; comparator; parity check and generator.
5. **Converters:** Digital to analog converter; Weighted register DAC R-2R ladder; DAC specifications; Analog to digital converters; Digital ramp ADC; Successive approximation ADC; Flash ADC; ADC and DAC IC;
6. **Semiconductor Memories:** Memory organization and operations; Expansions of word size; classification and characteristics of memory. Memory Terminology: RAM and Rom; SRAM and DRAM.

Books Recommended:			
	Authors		**Books**
1.	*A. P. Malvino, and Leach. D.P*	**:**	Digital Principles and Applications
2.	*A. P. Malvino*	**:**	Digital Computer Electronics
3.	*Mano, M. Morris*	**:**	Digital Logic and Computer Design
4.	*Tocci*	**:**	Digital Systems, Principles and Applications
5.	*L. Nashelsky*	**:**	Introduction to Digital Computer Technology

Course Code: PHY-507	Course Title: Physics Lab- V	Credit: 1.5

1. To determine the logarithmic decrement of ballistic galvanometer and hence to determine its critical damping resistance.
2. To study the frequency response of a LCR series circuit and determination of a factor.
3. To study the frequency response of a LCR parallel circuit and determination of a factor.
4. Determination of the absolute capacitance of a condenser.
5. To draw the characteristic curves of a PN junction.
6. To draw the characteristic curves for a Zener diode and to study it as a voltage regulator.
7. To design and construct a half-wave rectified power supply and to find the efficiency and ripple factor.
8. To design and construct a full-wave rectified power supply and to find the efficiency and ripple factor.

Books Recommended:			
	Authors		**Books**
1.	*Giasuddin Ahmad and, Md. Shahabuddin*	**:**	Practical Physics for Degree Students
2.	*C.L. Arora*	**:**	B.Sc. Practical Physics
3.	*Harnam Singh*	**:**	B.Sc. Practical Physics
4.	*Kalimuddin*	**:**	B.Sc. Practical Physics
5.	*Giasuddin Ahmad and Fatema Nasreen*	**:**	Advanced Practical Physics

Course Code: PHY-508	**Course Title: Viva**	**Credit: 1.0**

6th Semester

Course Code: PHY-601	**Course Title: Nuclear Physics-II**	**Credit: 3.0**

1. **Nuclear Force and Nuclear Models:** General Properties and Characteristics of nuclear force; Exchange forces; Yukawa proposal; Meson theory of nuclear forces; Shell model-single particle shell model; Introductory collective model; Magic numbers; L-S coupling; J-J coupling.
2. **Interaction of nuclei with Electromagnetic Radiation:** Introduction; Multiple radiation and selection rules; The probability of multiple emission and absorption; Radiative transition between low-laying states of nuclei; Transition involving highly excited states.
3. **Nuclear Reactions:** Different types of Reactions; The energies of Nuclear Reactions; Conservation of Physical

Quantities in Nuclear Reaction; Nuclear cross-section; Breit-wigner dispersion formula for an s-state; Compound nucleus; Bohr compound nucleus hypothesis; Elastic and inelastic process; Direct reaction; Optical model; Neutron cycle and four factor formulas; Nuclear reactors; Homogeneous and in homogeneous reactor system.

4. **Elementary particles:** Fundamental interactions; Unification of forces; Particle, antiparticle; Classification and general properties; Quantum number and their conservation; Idea of quarks; Gluon color.

Books Recommended:			
	Authors		**Books**
1.	*Roy, RR and Nigam, BP*	**:**	*Nuclear Physics*
2.	*Islam, GS*	**:**	*Paramanbik Ebong Nucleo Padarthabijnan*
3.	*Enge, HA*	**:**	*Introduction to Nuclear Physics*
4.	*Segre, E*	**:**	*Nuclei and Particles*
5.	*Cohen, BL*		*Concept of Nuclear Physics*
6.	*Blatt, JM and Weiskopff, VF*		*Theoretical Nuclear Physics*
7.	*Elton, LRB*		*Introductory Nuclear Theory*
8.	*Burcham and Jobes*		*Nuclear and Particle Physics*

Course Code: PHY-602	Course Title: Quantum Mechanics II	Credit: 3.0

1. **Operator Method in Quantum Mechanics :**Operator; Different types of operators; Eigen functions and Eigen values of operators; Orthogonality of Eigen functions; Commutating operators; Heisenberg uncertainty relation; Dirac's bra and ket notation; Eigen values and eigen kets; Orthogonality of eigen kets.
2. **Matrix Formulation of Quantum Mechanics:** State vectors; linear vector spaces; Hilbert space; Orthonormal system; Matrix representation of state vectors and operators; Change of representation; Simple harmonic oscillator.
3. **One Dimensional Problem with Schrödinger Equation:** Free particle in quantum mechanics; Particle in a potential (step, square well, etc.) barrier; Reflection and transmission coefficients; Energy levels calculation; Tunneling through a potential barrier; Linear harmonic oscillator.
4. **Three Dimensional Problems:** The free particle and free particle in a box; spherically symmetric potentials; three-dimensional square well potential and harmonic oscillator.

Books Recommended:			
	Authors		**Books**
1.	*K. Ziock*	**:**	Basic Quantum Mechanics
2.	*P. T. Matthews*	**:**	Introduction to Quantum Mechanics
3.	*S. L. Powell & D Crascmann*	**:**	Quantum Mechanics
4.	*L. Pauling & B Wilson*	**:**	Quantum Mechanics
5.	*V. Rojansky*	**:**	Introduction to Quantum Mechanics
6.	*Gupta, Kumar, Sharma*	**:**	Quantum Mechanics

Course Code: PHY-603	Course Title: Solid State Physics-II	Credit: 3.0

1. **Defects in Crystals:** Classification of defects; Point defects; Dislocations; Screw and edge dislocations; Diffusion in metals; Plane defects; Crystal grains and grain boundaries; Energy of grain boundaries.
2. **Free Electron Theory of Metals:** Classical electron theory; Somerfield theory; Box quantization; Density of states; Fermi surface; Fermi energy; Electrical conductivity; Wiedemann-Franz law.
3. **Band Theory of Solids:** The Bloch theorem; The Kronig-Penney model; The motion of electrons in one dimension; Distinction between metals, insulators and intrinsic semiconductors; The concept of a hole.
4. **Energy Bands and Semiconductors:** Nearly free electron model: Energy bands of metal, insulator and semiconductor; Fermi-Dirac distribution in insulators and semiconductors; Electrons, holes and their effective masses; Density of states in intrinsic semiconductors; Impurities in semiconductors; p- and n-type semiconductors; Electrical conductivity and Hall effect; Motion of electrons in one and three dimensions in a periodic potential.
5. **Magnetism:** Origin of magnetism; Classification of magnetic materials; Diamagnetism, Paramagnetism and ferromagnetism; Ferromagnetic domain; Bloch Wall hysteresis loop; Magnetic anisotropy; Antiferromagnets and ferrites.

Books Recommended:			
	Authors		**Books**
1.	*A. J. Dekker*	**:**	Solid State Physics
2.	*C. Kittel*	**:**	Introduction to Solid State Physics
3.	*Mckelvey*	**:**	Solid State Semiconductor Physics
4.	*F. Brailsford*	**:**	Principles of Magnetism
5.	*Chikazum*	**:**	Physics of Magnetism
6.	*R.L. Singha*	**:**	Introduction to Solid State Physics

Course Code: PHY-604	**Course Title: Plasma Physics**	**Credit: 3.0**

1. **Introduction:** Occurrence of plasma in nature; Definition of plasma; Basic concepts of temperature; Debye length; Plasma parameters; Distribution function; Plasma frequency; Criteria for plasmas; Plasma production; Application of plasma physics.
2. **Single-Particle Motions:** The equations of motion; Motion of charged particles in static homogeneous Electric and magnetic fields; Motion of charged particles in nonuniform E and B fields; Motion of charged particles in time-varying E and B fields; Adiabatic invariants.
3. **Plasma as a Fluid:** Relation of plasma physics to ordinary electromagnetic; the fluid equation of motion; the complete set of fluid equations; fluid drifts; plasma approximation.
4. **Waves in Plasmas:** Representation of waves; Group velocity and phase velocity; Plasma oscillations; Electron plasma waves; Sound waves; Ion waves; Comparison of ion and electron waves; Electrostatic electron and ion waves in magnetic fields; Electromagnetic waves in magnetic fields.

5. **Kinetic Theory:** The meaning of distribution function f (v); Equations of kinetic theory; Derivations of fluid equations; Plasma oscillations and Landau damping.

Books Recommended:			
	Authors		**Books**
1.	*Chen, F. F.*	**:**	Introduction to Plasma Physics. And Controlled Fusion
2.	*Krall, N. A and Tricvelpiece, A.W.*	**:**	Principles of Plasma Physics
3.	*Bittencourt, J. A.*	**:**	Fundamentals of Plasma Physics
4.	*Ichimau, S.*	**:**	Plasma Physics
5.	*Arimovich, L. A.*	**:**	Elementary Plasma Physics

Course Code: PHY-605	**Course Title: Electrodynamics-II**	**Credit: 2.0**

1. **Elements of Magnetostatics:** Calculation of the vector potential for current carrying loop; Boundary value problems in magnetostatics.
2. **Wave Guides:** Solution of the wave equation in a cylindrical and rectangular waveguide; TE, TM and TEM modes and their differences; Cut-off frequencies; phase and group velocities in a waveguide.
3. **Radiation From Non-Static Charges:** Radiation from an oscillating dipole; Radiation from a half-wave antenna; Radiation from a group of moving charges.
4. **Radiation From an Accelerated Charge:** Lienard and Wicehart potentials; Field of a charge in uniform motion; Fields of an accelerated charge; Radiation fields of charges moving with low velocities.

5. **Radiation, Scattering & Dispersion:** Forced vibration; Scattering by an individual free electron; Normal and anomalous dispersion; Scattering by a bound electron; Absorption of radiation by an oscillator; Rayleigh scattering; Thomson scattering; Resonance scattering.
6. **Relativistic Electrodynamics:** Lagrangian formulation of electrodynamics; covariant formulation of electrodynamics.

Books Recommended:			
	Authors		**Books**
1.	*Reitz J. R. and Milford, F. J.*	**:**	Foundations of Electromagnetic Theory
2.	*Penofsky, W. R. H and Philolps M.*	**:**	Classical Electricity and Magnetism
3.	*Corson D. R. and Lorrain P.*	**:**	Introduction to Electromagnetic Fields and Waves
4.	*Griffiths D. J.*	**:**	Introduction to Electrodynamics
5.	*Jackson J. D.*	**:**	Classical Electrodynamics
6.	*J.D. Fackson*	**:**	Classical Electrodynamics
7.	*N. Tralli*	**:**	Classical Electromagnetic Theory
8.	*R. Reifz& F. J. Milford*	**:**	Foundations of Electromagnetic Theory
9.	*D. R.. Corson & Lorrain*	**:**	Introduction to Electromagnetic Fields and Waves

Course Code: PHY-606	Course Title: Physics Lab-VI	Credit: 1.5

1. To study the static characteristic a npn or pnp transistor in common base (ii) common emitter arrangement
2. To study the frequency response characteristic of a RC low pass and band pass filter circuits.
3. To study the charging and discharging of a capacitor in an RC circuit and to determine the exponential relaxation time constant.
4. To find the value of e/m for an electron by Helmholtz coil
5. To draw the characteristics curves of atriode and hence to determine its constants
6. To verity the Faraday laws of induction
7. To determine the threshold frequency for photo-electric effect of a photo-cathode and the value of the Planck's constant by using a photo-electric cell
8. Determination of the self-inductance of a cell by Rayleigh's method

Books Recommended:			
	Authors		**Books**
1.	*Giasuddin Ahmad and, Md. Shahabuddin*	**:**	Practical Physics for Degree Students
2.	*C.L. Arora*	**:**	B.Sc. Practical Physics
3.	*Harnam Singh*	**:**	B.Sc. Practical Physics
4.	*Kalimuddin*	**:**	B.Sc. Practical Physics
5.	*Giasuddin Ahmad and Fatema Nasreen*	**:**	Advanced Practical Physics

Course Code: PHY-607	Course Title: Viva	Credit: 1.0

7th Semester

Course Code: PHY-701	Course Title: Nuclear Physics-III	Credit: 3.0

1. **Two- Nuclear system (Deuteron problem):** Ground state of deuteron; Normalization of the deuteron wave function; Central potentials; Non-existence of excited states; Tensor force; Magnetic dipole moments and electric quadruple moments of deuteron.
2. **Scattering:** N-P and P-P scattering at low and high energies; Spin dependence of N-P scattering; Scattering length; Phase shift; Coherent scattering of thermal neutrons; Effective range theory; Ortho and Para hydrogen.
3. **Neutron Physics:** Sources of neutrons, interactions of neutrons with matter; Thermal neutrons; Cross-section for neutron induced reactions; Scattering; Absorption cross-section.
4. **Nuclear Shell Model:** Shell model; Single particle shell model; Wave Function and energy levels; Magic numbers; Prediction of spin and magnetic moments; Schmid values and lines; L-S coupling and J-J coupling.
5. **Collective Model:** Rotational energy spectrum and nuclear wave function for ever-ever nuclei and for odd-odd nuclei; Beta and gamma decay; Auger effect; Neutrino hypothesis.
6. **Optical Model:** Optical potential energy; Averaged cross-section; Optical model at low energy, global optical potential.

Books Recommended:			
	Authors		**Books**
1.	*H.A Preston*	**:**	Physics and Nucleus
2.	*Blatt and Weisskopf*	**:**	Theoretical Nuclear Physics
3.	*M.A. Enge*	**:**	Introduction to Nuclear Physics
4.	*R.R Roy, and B.P. Nigam*	**:**	Nuclear Physics: Theory and Experiment
5.	*L.R. Elton*	**:**	Introduction to Nuclear Physics
6.	*C. M. H Smith*	**:**	A Text Book of Nuclear physics
7.	*S.E Liverhant*	**:**	Elementary Introduction to Nuclear Physics
8.	*G Suresh, Feroz Ahmed and L.S Kotheri*	**:**	Physics of Nuclear Reactor
9.	*Kenneth, S. Krane*	**:**	Introductory Nuclear Physics
10.	*I. Kaplan*	**:**	Nuclear Physics

Course Code: PHY-702	**Course Title: Quantum Mechanic-III**	**Credit: 3.0**

1. **Angular Momentum:** Angular momentum and its matrix representation.
2. **Symmetry in Quantum Mechanics:** Space and time displacements; the group concept; Rotation; Angular momentum and unitary group; Combination of angular momentum states and tensor operators.
3. **Approximation Methods:** WKB approximation method; Time independent and time-dependent perturbations; Density

of states and transition probability; Applications; Zeeman effect and Stark effect.

4. **Theory of Scattering:** Scattering of particles by spherically symmetric potentials; Partial waves phase shifts; General formulation of scattering theory; Born's approximations.
5. **Identical Particles:** Symmetric and ant symmetric wave functions; The exclusion principle; Spin and statistics; Spin matrices.

Books Recommended:			
	Authors		**Books**
1.	*K. Ziock*	**:**	Basic Quantum Mechanics
2.	*P. T. Matthews*	**:**	Introduction to Quantum Mechanics
3.	*S. L. Powell & D Crascmann*	**:**	Quantum Mechanics
4.	*L. Pauling & B Wilson*	**:**	Quantum Mechanics
5.	*V. Rojansky*	**:**	Introduction to Quantum Mechanics
6.	*Gupta, Kumar, Sharma*	**:**	Quantum Mechanics

Course Code: PHY-703	**Course Title: Solid State Physics-III**	**Credit: 3.0**

1. **Dielectric Properties:** Macroscopic electric field; Local electric field; Dielectric constant; Electronic, ionic and orientational polarizabilities; Clausius-Mossotti relation; Measurement of dielectric constant; Dielectrics in an AC field; Relaxation and dielectric loss.
2. **Thermal Properties of Solids:** Specific heats of solids; Breakdown of classical theory; Einstein theory; Debye theory

and its modification by Born; Gruneisen constant; Harmonic crystal interaction; Thermal expansion; Thermal conductivity; Thermal resistivity; Umklapp process.

3. **Electrical Properties of Solids:** Dielectric and ferroelectric properties of solids; Dielectric constant and polarizability; Liddane-Sachs-Teller relation; Dielectric relaxation time; Dipole theory of ferro-electricity; Antiferro electricity; Piezo electricity.
4. **Superconductivity:** Introduction; Zero resistance; Meissner effect; Critical field; Two fluid model; Intermediate states; Persistent current; Type I and type II superconductors; Isotope effect; Thermodynamics of superconductivity; London equation; Cooper pairs; Brief ideas on BCS theory and its application.

Books Recommended:			
	Authors		**Books**
1.	*A. J.Dekker*	**:**	Solid State Physics
2.	*C.Kittel*	**:**	Introduction to Solid State Physics
3.	*Mckelvey*	**:**	Solid State Semiconductor Physics
4.	*F.Brailsford*	**:**	Principles of Magnetism
5.	*Chikazum*	**:**	Physics of Magnetism
6.	*R. L. Singha*	**:**	Introduction to Solid State Physics

Course Code: PHY-704	**Course Title: Material science**	**Credit: 3.0**

1. **Liquid Crystals:** Structure and Classifications of Different Phases; Orientation Order; Magnetic Effects; Optical Properties; Introduction to Theories of Liquid Crystalline Phases; Glass; Glass Transition Temperature;

2. **Engineering Materials:** Classification of Engineering Materials; Engineering Requirements of Materials; Structures and Properties of Non-metallic Materials; Portland cement; Ceramics; Cermet.
3. **Elastic Properties and Hardness of Materials:** Elastic Constants; Elastic Wavesin Crystals; Creep; Fatigue; Hardness Testing; Hardness Scales.
4. **Diffusion in Solids:** Classification of Diffusion; Diffusion Mechanism; Diffusion Coefficient; Fick's Law; Self-Diffusion; Inter-Diffusion; Diffusion with Constant Concentration; Diffusion in Oxides and Ionic Crystals.
5. **Theory of Alloys:** Solid Solution; Hume-Rothery's Rules; Intermediate Compound or Intermediate Phases; Phase Diagrams; Gibb's Phase Rule; The Lever Rule; Equilibrium Diagram of a Binary System; Eutectic and Eutectoid Systems.
6. **Superconductivity:** Superconductivity of material, Type- 1, type-2 superconductor and some applications;
7. **Introduction to Nanomaterial's:** Nano scale fabrication: nanolithography, Self-assembly and self-organization, Carbon nanotubes, quantum dot and nanocomposites.

Books Recommended:			
	Authors		**Books**
1.	*W. Brostow*	**:**	Science of Materials
2.	*E. Abdrson*	**:**	Fundamentals of Solar Energy Conversion
3.	*A. V. Narlikers*	**:**	Introduction to Superconductivity
4.	*Van-Vlack, L.H.*	**:**	Elements of Materials Science and Engineering

5.	*Kumar, D., Jain, S. K. and Bhargava, A. K.*	**:**	Material Science and Manufacturing Processes
6.	*Starfield, M. J. and Shvager A. M.*	**:**	Introductory Materials Science
7.	*Longman*	**:**	Introduction to Magnetic Materials

Course Code: PHY-705	**Course Title: Geophysics**	**Credit: 2.0**

1. **The Solar System:** The planets; Meteorites and their composition; Cosmic ray exposures of meteorites; The pointing-Robertson effect; Compositions of terrestrial planets.
2. **Rotation and Figure of The Earth:** Figure of the earth; Precession of the equinoxes; The Chandler wobble; Tidal friction and the history of the earth-moon system; Fluctuation in rotation and the excitation of the wobble.
3. **The Gravity Field:** Gravity as a Gradient of the geopotential; The satellite geoid; Crustal structure and the principle of isostasy; Earth tides.
4. **Seismology and The Internal Structure of The Earth:** Seismicity of the earth; Elastic waves and seismic rays; Travel time and velocity depth curves for body waves; Internal density and composition; Free oscillation.
5. **Geomagnetism:** The magnetism of the earth; Fundamental equations; Measurement of the magnetic field; Method of Gauss; Saturation induction magnetometer; Proton precession magnetometer; Alkali vapor magnetometer.

6. **The Earth's Internal Heat:** The geothermal flux; Thermal conduction in the mantle; Temperatures in the interior of the earth; Energy source for the geomagnetic dynamo.
7. **Radioactivity and The Age of The Earth:** The pre-radioactivity age problem; Radioactive elements and the principle of radiometric dating; Age of the earth and meteorites; Dating the nuclear synthesis

Books Recommended:			
	Authors		**Books**
1.	*F. D. Stacey*	**:**	Physics of the Earth
2.	*G.D. Garland*	**:**	Introduction to Geophysics: Mantle, Core and Crust
3.	*F.S Grant and G.F. West*	**:**	Interpretation Theory in Applied Geophysics
4.	*F.M. Telford; L.P. Geldart R.E. Sheriff. D. A. Keyes*	**:**	Applied Geophysics
5.	*D.S. Parasnis:*	**:**	Principle of Applied

Course Code: PHY-706	**Course Title: Physics Lab-VII**	**Credit: 1.5**

1. To determine the plateau of a Geiger-Mueller counter and hence to find its operation voltage.
2. To demonstrate the random nature of the emission of 8-particles from radioactive source and to introduce statistical methods of predicting and interpreting the results of radioactive measurements
3. To determine the dead time of a Geiger-Mueller counter.

4. Determination of the current voltage characteristics of an ionization chamber and the range of alpha particles.
5. To construct and study a two-transistor radio receiver.
6. To construct and study a two-transistor radio transmitter
7. To fabricate and test a phase shift oscillator using a transistor and (a) To measure the frequency of oscillation (b) To compare the Measured value of frequency with that of the calculated value (c) To observe the effect of using two RC section instead of three
8. To design and construct a summing amplifier using a 741 OP-AMP and Show the summing in a tabular form for three different values of gain.
9. To verity Stefan's law and hence to determine Stefan's constant.

Books Recommended:			
	Authors		**Books**
1.	*Giasuddin Ahmad and, Md. Shahabuddin*	**:**	Practical Physics for Degree Students
2.	*C.L. Arora*	**:**	B.Sc. Practical Physics
3.	*Harnam Singh*	**:**	B.Sc. Practical Physics
4.	*Kalimuddin*	**:**	B.Sc. Practical Physics
5.	*Giasuddin Ahmad and Fatema Nasreen*	**:**	Advanced Practical Physics

Course Code: PHY-707	**Course Title: Viva**	**Credit: 1.0**

8th Semester

Course Code: PHY-801	Course Title: Astronomy and Cosmology	Credit: 3.0

1. **Introduction:** Modern astronomy; Astronomical coordinates; Rough scales of the astronomical universe; Contents of the universe.
2. **Stars:** Properties of stars; Formation of stars; the end states of stars; white dwarfs, neutron stars;The sun as a star, Surveying the solar system; the interior of the sun; The sun's outer layers; The source of energy of the sun.
3. **Galaxies:** Formation and classification of galaxies; Cosmic rays; The milky way system; Spiral structure; Density wave theory; Active galaxies; Peculiar galaxies and quasars; Clusters of galaxies.
4. **Expansion of the Universe:** Red shifts; Hubble's law regarding expansion of the universe; Age of the universe.
5. **Big Bang Theory and Cosmology:** Static cosmological models; Expanding cosmological models and the Big bang theory; The early universe; The universe and the subatomic; Life and intelligence in the universe.

Books Recommended:			
	Authors		**Books**
1.	*Shu, F. H.*	**:**	The Physical Universe; An Introduction to Astronomy
2.	*Seeds, M. A.*	**:**	Horizons: Exploring the Universe
3.	*Hawking, S. W*	**:**	A Brief History of Time
4.	*Bermu, L. and Evans, J. C.*	**:**	Exploring the Cosmos

5.	*Hoyle, F.*	**:**	Highlights in Astronomy
6.	*Kutner, M. L.*	**:**	Astronomy; Physical Prospective
7.	*Snow, T. P.*	**:**	The Dynamic Universe
8.	*Smith, E. V. P. and Jacobs, K. C.*	**:**	Introduction to Astronomy and Astrophysics

Course Code: PHY-802	**Course Title: Radiation and Health Physics**	**Credit: 3.0**

1. **Interaction of Radiation with Matter:** Beta Rays: Range-energy relationship, mechanisms of energy loss (Ionization and Excitations, Bremsstrahlung); Alpha Rays: Range-energy relationship; Energy Transfer, Gamma Rays: Exponential absorption, interaction mechanisms, Neutrons: Production, classification, Interaction: Scattering, absorption, neutron activation.
2. **Radiation Dosimetry:** Units: Absorbed dose, exposure; Exposure Measurement: Free air chamber; Exposure Measurement: Air wall chamber, exposure dose relationship, Absorbed Dose Measurement: Bragg-Gray principle, kerma, Source Strength: Specific gamma ray emission, internally deposited radioisotopes, corpuscular radiation, effective half-life; Total Dose: Dose commitment, gamma emitters, MIRD method, neutrons.
3. **Biological Effects of Radiation:** Dose-Response Characteristics: Direct action, indirect action, Radiation Effects: Acute effects, delayed effects; Risk Estimates: BEIR III, Relative biological effectiveness (RBE) and quality factor (QF); Dose Equivalent: Sievert (and the Rem), high energy radiation.

4. **Radiation Protection Guides:** Organizations of Set Standards: ICRP, IAEA, ILO, ICRUM, NCRPM, Philosophy of Radiation Protection; Basic Radiation Safety Criteria: Effective dose equivalent, exposure of individuals in the general public, exposure of populations, medical exposure, allowable limit of intake (ALI), inhaled radioactivity, derived air concentrations (DAC), gastrointestinal tract, combined exposure; Basis for radiation Safety Regulations: Calculation of MPC in drinking water based on dose to critical organ, concentration in drinking water based on comparison with radium, airborne radioactivity, maximum permissible concentrations for non-occupational exposure.
5. **Health Physics Instrumentations:** Radiation Detectors: Particle counting instruments, gas filled particle counters, ionization chamber counter, proportional counter, Geiger counter, quenching a Geiger counter, Resolving Time: Measurement of resolving time, scintillation counters, nuclear spectroscopy, Cerenkov detector, semiconductor detector; Dose-Measuring Instruments: Pocket dosimeters, film badges, thermo luminescent dosimeter.
6. **External Radiation Protection:** Basic Principles; Techniques of External Radiation Protection: Time, distance, shielding, X-ray shielding, beta ray shielding, neutron shielding.
7. **Internal Radiation Protection:** Internal radiation hazard; Principles of Control: Control of the source, confinement, environmental; control of Man: Protective clothing, respiratory protection, surface contamination limits; Waste Management: High, intermediate and low-level liquid wastes.

Books Recommended:			
	Authors		**Books**
1.	*Herman Cember*	**:**	Introduction to Health Physics
2.	*Fayez Ahmed Khan*	**:**	Physics for Radiotherapy
3.	*Lapp, R. E., and Andrews, H.L.*	**:**	Nuclear Radiation Physics
4.	*Martin, A., and Harbison, S.A.*	**:**	An Introduction to Radiation Protection

Course Code: PHY-803	**Course Title: Biomedical Physics**	**Credit: 3.0**

1. **Properties and Structure of Macromolecules:** Atomic and molecular forces; Nucleic Acids (DNA, RNA); Methods of replication; Amino-acids.
2. **The Cell Membrane:** Properties of membrane; Transport and diffusion of ions and molecules through the cell membrane; Basic physics of membrane potentials; Measurement of membrane potentials; Membrane model.
3. **Basic Enzyme Behavior:** Michelis manten mechanism and MWC model.
4. **Neuromuscular Physics:** Overview of the central nervous system; Origin of resting and action potentials in neurons and muscle fibers; Propagation of action potentials through neuromuscular system; Huxley-Hodgkin theory; Neurotransmitters.
5. **Physics of the Cardiovascular System:** Introductory concepts; Bernoulli's principle applied to cardiovascular system; Generation of Korotkoff sound and indirect measurement of blood pressure.

6. **Physics of the Heart:** Electrical activity of heart; ECG/EKG measurement; Typical waveforms and physiological origins of the major peaks in the wave form; Artificial pacemaker.
7. **Imaging Techniques:** Nature, production and detection of ultrasounds; A-scan, B-scan, M-scan, CT, MRI and gamma camera; Clinical applications.
8. **Image Processing and analysis:** Digital image fundamentals; Image smoothing; Restoration and enhancement; Image segmentation and pattern recognition.
9. **Nuclear Medicine:** Principle, choice of radionuclide and radiopharmaceuticals; Technetium generator; Imaging and function test of thyroid gland, liver, spleen, kidney, lungs, brain, heart, and bone.
10. **X-rays and Radiation Therapy:** Production and clinical applications of X-rays; Principles of radiation therapy; Radiotherapy treatment planning; Isodose curve; Simulator; Teletherapy; Brachytherapy.

Books Recommended:			
	Authors		**Books**
1.	*H. Chember*	**:**	Introduction to Health Physics
2.	*Brown B.H. and Small wood R.H.*	**:**	Medical Physics and physiological Measurements
3.	*Cameron J.R. and J. Skofronick*	**:**	Medical Physics
4.	*Brown B.H. and Small wood R.H, D.C Barber P V Lawford and D R Hose*	**:**	Medical Physics and Biomedical Engineering

5.	*Cromwell*	**:**	Biomedical Instrumentation and Measurement
6.	*Guyton*	**:**	Textbook of Medical Physiology
7.	*Sprawls, P*	**:**	Physical principle of Medical Imaging
8.	*Refael C. Gonzalez, R.E. Woods*	**:**	Digital Image Processing
9.	*Hande, W.R.*	**:**	Medical Physics of Radiation Physics
10.	*Johns and Cunnighum*	**:**	Physics of Radiology
11.	*Cesareo, R. et al.*	**:**	Nuclear Analytical Techniques in Medicine

Course Code: PHY-804	**Course Title: Electronic Communication**	**Credit: 2.0**

1. **Television:** Fundamentals of TV Transmission and reception of picture information, Scanning, Standard scanning pattern, Synchronization, Blanking pulses, Composite video signal, Vestigial sideband transmission, Line of sight transmission, TV channels.TV Transmitter & Receiver: Fundamentals of TV receiver, Picture tubes, Deflection circuit, High voltage power supply, Folded dipole with directors and reflectors for TV receiver, TV Transmitter and TV studio design, HDTV. Colour TV: Definition of Colour TV, Types of colour video signals, Matrix circuits, Colourplexed composite video signal, Fundamentals of colour TV receiver, Colour picture tube, LCD and other flat panel TV receivers
2. **Satellite Communication:** Introduction, Orbits, station keeping, satellite altitude, transmission path, path loss, noise

consideration, satellite system, saturation flux density, effective isotropic radiated power, multiple access methods, earth station antenna, satellite link design, frequency plan, satellite communication for Internet, VSAT network, One way, two way and opensky satellite communication, GNSS GPS and Galileo systems and GIS, Satellite Navigation, DBSTV.

3. **Radar:** Basic principles, Radar equation, factors influencing maximum range, effect of noise, power and frequencies used in Radar, types of Radar, Basic pulsed Radar system, Modulators, receivers, Bandwidth requirements, factors governing pulse characteristics, Duplexer, moving target indicator (MTI), tracking Radar systems and search systems.
4. **Optical fiber communication:** Introduction: Optical fibers; Structure, Step index and graded index fibers, Modes of propagation, modal theory for circular waveguide, Modal equations, Waveguide equations, Power flow in optical fibers, Signal degradation in optical fibers, Fiber attenuation, Distortion in optical guides, Dispersions, Mode coupling. Optical Sources and Detectors: Light emitting diode (LED) and semiconductor laser diode (SLD), Optical modulation and detection schemes, Direct and coherent detection receiver's configuration, operation, noise sources, sensitivity calculation, performance curves, Optical Amplifiers, Design of analog and digital receivers. Wavelength Division Multiplexing (WDM), Dense Wavelength Division Multiplexing (DWDM) and Optical frequency division multiplexing (OFDM) transmission schemes.

Books Recommended:			
	Authors		**Books**
1.	*John M. Senior*	**:**	Optical Fiber Communications, Principles and Practice
2.	*Djafar K Maenbaev*	**:**	Fiber Optic Communications Technology
3.	*Robert L. Shrader*	**:**	Electronic Commuication
4.	*R.R. Gulati*	**:**	Monochrome & Color Television
5.	*Marcelo S. Alencar*	**:**	Digital Television Systems
6.	*S. Y. Lao*	**:**	Microwave devices and Circuits
7.	*Robert M Gagliardi*	**:**	Satellite Communication

Course Code: PHY-805	**Course Title: Reactor Physics**	**Credit: 3.0**

1. **Nuclear Reaction:** Interaction of Neutrons with matter; Neutron cross- section; Energy dependence of neutron cross-section; Fission cross-section.
2. **Diffusion and Slowing Down of Neutrons:** Thermal neutron diffusion; Diffusion equations; Fast neutron diffusion and Fermi age equation; Energy distribution and cross-section of thermal neutrons; Slowing down of Neutrons; Transport mean free path; Critical equation and reaction buckling.
3. **Reactor Theory:** Neutrons lifetime; Reactor kinetic equation; Delayed neutron; Prompt neutron; Basic principle of reactor control; Multiplication factor; The Four factor

formula; Neutron leakage and critical size; Calculation of k for homogeneous reactors; Classification of reactors; Research reactors; Swimming pool water boiler; Power and breeder reactors; Heterogeneous reactors; Calculation of k for heterogeneous reactors.

4. **Reactor Fuels:** The fuel cycle; Production of reach fuels; Sources of uranium; Separation of uranium isotopes; Reprocessing of irradiated fuel; Radioactive Waste disposal.
5. **Energy Removal:** Thermal problems in reactors design; Design for cooling system; Heat sources in reactors systems; Reactor coolants.
6. **Control of Nuclear Reactors:** Reactor kinematics; General factors of reactor control; Effect of temperature on reactivity; Design of control system and reactor operation; Fission product poisoning.

Books Recommended:			
	Authors		**Books**
1.	*Liverhant, S. E.*	**:**	Elementary Introduction to Nuclear Reactor Physics
2.	*Glasstone, S. and Edelund M. G.*	**:**	Elementary of Nuclear Reactor Theory
3.	*Lamarsh, J. R*	**:**	Introduction to Nuclear Reactor Theory
4.	*Lamarsh. J. R.*	**:**	Nuclear Reactor Engineering
5.	*Glasstone, S. and Sessonske, A.*	**:**	Nuclear Reactor Engineering
6.	*Beck L. K.*	**:**	Nuclear Reactor for Research

7.	*Suresh, C., Feroz. A., Kothari. L. S.*	**:**	Physics of Nuclear Reactors

Course Code: PHY-806	**Course Title: Renewable Energy**	**Credit: 2.0**

1. **Introduction:** World Energy Requirement, Source of Energy: Solar energy, Wind Energy, Geothermal, OTEC, Wave Energy, Biomass, MHD, Chemical energy, Fuel cell, Nuclear Fusion.
2. **Solar Radiation:** Solar Radiation, Solar Constant, Solar Geometry, Azimuth, Declination, Day Length, Solar Length, Solar Time, Solar Radiation of Titled Surface, Monthly Average Solar Radiation, Measurement of Solar Radiation.
3. **Solar Collectors:** Flat Plate Collectors, General Description of Flat Plate Collector, Heat Transfer Properties of the Flat Plate Collector, Energy Balance, Temperature Distribution, Collector Overall Heat Transfer Coefficient, Collector Efficiency Factor, Heat Removal Factor and Flow Factor.
4. **Energy Storage:** Energy storage in solar process system, Types of Energy Storage, Sensible Heat Storage, Latent Heat Storage, Phase change energy storage, Thermo- chemical Storage.
5. **Photovoltaics:** Interaction of Light with Semiconductor, Absorption and Recombination Process, Photovoltaic Principles, Semiconductor Junction, Power output and Conversion Efficiency, Efficiency Limiting factor.
6. **Photovoltaic System and Modules:** Basic Photovoltaic System for Power Generation, Solar Modules, Module Circuit Design, Application of Photovoltaic System.
7. **Other Source of Non-Conventional Energy:**
   a) **Wind Energy:** Suitability of Wind Power, Factors of Wind Speed, Height above Ground and Terrain

Characteristics, Betz' Law, Basic Wind Power System, Advantage and Disadvantages of Wind Power.

b) Biomass and Biogas: Source of biomass method of obtaining energy, Introduction to
Water Power and Tidal Power.

Books Recommended:			
	Authors		**Books**
1.	*Rai, G.*	**:**	Solar Energy Utilization
2.	*Rai*	**:**	Non-Conventional Source of Energy
3.	*Rapp, D.*	**:**	Solar Energy
4.	*Duffie, J. A.*	**:**	Solar Cell
5.	*Magal, B. S.*	**:**	Solar Power Engineering
6.	*Anderson*	**:**	Fundamental of Solar Energy Conversion
7.	*Fisk and Anderson*	**:**	Introduction to Solar Technology

Course Code: PHY-807	**Course Title: Physics Lab-VIII**	**Credit: 1.5**

1. Experiment with a cathode ray oscilloscope(a) synchronizing the time bass of aoscilloscope (b) Calibration of a CRT for both dc and ac sources (c) Measurement of an unknown frequency using Lissajous' figures.
2. To calibrate the frequency dial of a signal generator with the help of line frequency by forming Lissajous' figures on an oscilloscope screen.
3. To determine the velocity of sound by acoustic transducer.

4. To design and construct a saw-tooth wave generator (relaxation oscillator) and determine its repetitive frequency.
5. To construct an astable (free running) multi-vibrator and to measure its frequency from the display of its output waveforms on an oscilloscope screen.
6. To draw the static characteristics of a field effect transistor (FET) and to determine its parameters.
7. To construct the basic gates using diodes and Transistors and also verity its truth table and cheek the corresponding Boolean algebra.
8. To study a half adder and full adder circuit using IC logic gates.
9. To construct NOR and NAND gates.

Books Recommended:			
	Authors		**Books**
1.	*Giasuddin Ahmad and Md. Shahabuddin*	**:**	Practical Physics for Degree Students
2.	*C.L. Arora*	**:**	B.Sc. Practical Physics
3.	*Harnam Singh*	**:**	B.Sc. Practical Physics
4.	*Kalimuddin*	**:**	B.Sc. Practical Physics
5.	*Giasuddin Ahmad and Fatema Nasreen*	**:**	Advanced Practical Physics

Course Code: PHY-808	**Course Title: Viva**	**Credit: 1.0**