MAA PATESWARI UNIVERSITY, BALRAMPUR, UTTAR PRADESH

Structure of Syllabus for the Program: M.Sc. Subject: Physics

w. e. f. Session 2025-26

Structure of Syllabus Developed by			
Name of BOS Convener/ BOS Member	**Designation**	**Department**	**College/ University**
Prof. Jitendra Singh	Convener	Faculty of Physics	Shri Lal Bahadur Shastri Degree College, Gonda
Dr. Alok Shukla	Member	Physics	M. L. K. P. G. College, Balrampur
Sri Santosh Kumar Srivastava	Member	Physics	Shri Lal Bahadur Shastri Degree College, Gonda
Dr. Suraj Kumar Rai	Member	Physics	A. N. D. Kisan P. G. College, Babhnan, Gonda
Prof. Rakesh Tiwari	External Expert	Physics	Pt. Deen Dayal Upadhyay University, Gorakhpur
Prof. Om Prakash Yadav	External Expert	Physics	K.S. Saket P.G. College, Ayodhya
Dr Ram Kishor Singh	External Expert	Physics	Shivpati Degree College, Shohratgarh, Siddharthnagar

Course Code		**Course Title**	**Credits**	**T/P**	**Evaluation**	
					CIE	**ETE**
A	**B**	**C**	**D**	**E**	**F**	**G**
SEMESTERI(YEAR I)						
B010701T	CORE	Mathematical Methods for Physics	4	T	25	75
B010702T	CORE	Atomic & Molecular Spectroscopy	4	T	25	75
B010703T	CORE	Quantum Mechanics	4	T	25	75
B010704T	FIRST ELECTIVE (Select any one)	Numerical Methods and C Programming	4	T	25	75
B010705T		Lasers, Optical Fibers, and Sensors	4	T	25	75
B010706P	SECOND ELECTIVE (Select any one)	PhysicsLab-1	4	P	50	50
B010707P		ElectronicsLab-1	4	P	50	50
SEMESTERII(YEAR I)						
B010801T	CORE	Advanced Quantum Mechanics	4	T	25	75
B010802T	CORE	Electrodynamics	4	T	25	75
B010803T	CORE	Electronics	4	T	25	75

B010804T	THIRD ELECTIVE (Select anyone)	Physics in Daily Life	4	T	25	75
B010805T		Home Appliances	4	T	25	75
B010806P	FOURTH ELECTIVE (Select anyone)	PhysicsLab-2	4	P	50	50
B010807P		ElectronicsLab-2	4	P	50	50
SEMESTER III (YEAR II)						
B010901T	CORE	Nuclear Physics	4	T	25	75
B010902T	CORE	Statistical Physics	4	T	25	75
B010903T	CORE	Materials: Introduction, Synthesis, and Processing	4	T	25	75
B010904T	FIFTH ELECTIVE (Select anyone)	Opto electronics and Optical Communication	4	T	25	75
B010905T		Renewable Energy Resources	4	T	25	75
B010906P	SIXTH ELECTIVE (Select anyone)	PhysicsLab-3	4	P	50	50
B010907P		ElectronicsLab-3	4	P	50	50
SEMESTER IV(YEAR II)						
B011001T	CORE	Condensed Matter Physics	4	T	25	75
B011002T	CORE	Communication and Microwave Electronics	4	T	25	75
B011003T	CORE	Digital Electronics & Microprocessor	4	T	25	75
B011004P	SEVENTH ELECTIVE (Select anyone)	PhysicsLab-4	4	P	50	50
B011005P		ElectronicsLab-4	4	P	50	50
B011006P	RESEARCH PROJECT/ DISSERTATION	Major Research Project/Dissertation	8	P	50	50

Program Outcomes (POs):
1. The program has been designed in such a way that the students acquire strong theoretical and practical knowledge in various domains of Physics. 2. The program includes details of Mathematical Physics, Quantum Mechanics, Statistical Mechanics, Molecular and Atomic Physics, Nuclear and Particle Physics, Electronic Devices, Digital Systems, Microprocessor, Communication System, Electrodynamics, etc to provide in depth knowledge of Physics and Electronics so that they can contribute in the society in their respective research area and become entrepreneur. 3. The practical courses have been designed to equip the students with the laboratory skills in Physics& Electronics. Students will able to hardware design, application of various devices and circuits for system design and verification. 4. The program will offer students with the knowledge and skill base that would enable them toundertakeadvancedstudiesinfieldofPhysicsandrelatedareasorinmultidisciplinary areas that involves Physics. 5. The students will get exposure of wide range of careers that includes, Particle Physics, Atomic Physics and Communication Physics. 6. The students will gain domain knowledge for successful career in academia, industry and research. 7. Moreover,studentswilllearnvaluesforlifelonglearningtomeettheever-evolving Professional demands by developing ethical, interpersonal and team skills.

B010701T: Mathematical Methods for Physics

Course Outcomes (COs):

At the end of this course, students will be

1. Abletounderstandtheapplicationofmathematicsinsolvingtheproblemsrelated to Physical Sciences.
2. Use of Residue theorem and Integral formula to evaluate various integrals.
3. Use of Laplace Transform to solve the differential equation.
4. Abletoinculcatethehabitofmathematicalthinkingandlifelonglearning.

Unit I

Errors and Measurements

GeneralformulaforErrors-ErrorsanditsTypes-GraphicalMethod-Empiricalformula-Principle ofLeastSquares-Fittingastraightline-FittingaParabola-FittinganExponentialCurve-Fittingthe curve (y=axb)

Unit II

Special Functions:

Second order ordinary differential equations, Legendre's equation, Legendre polynomials and their properties, Bessel's equation, Bessel function and their properties, Laguerre's equation, its solutions and properties, Hermite equation, Hermite Polynomials and their properties. Green's function.

Unit-III

Complex Variables:

Functions of a complex variable–Single and multi-valued functions-Analytic functions-Cauchy Riemann conditions – Singular points - Cauchy's integral theorem and formula - Taylor and Laurent expansions – Zeros and poles - Residue theorem - applications to evaluation of definite integrals.

Unit-IV

Laplace and Fourier Transform:

Laplace transforms: solution of linear differential equations with constant Coefficients – Fourier integral. Fourier transforms: Fourier sine and cosine transforms – Convolution theorems – Applications.

References:

1. MathematicalmethodforPhysicists,Arfken&Weber,ElsevierAcademicPress
2. Mathematical Method for Physics and Engineers,K.F.Reily,M.P.HobsonandS.J.Bence, Cambridge University Press
3. Advanced Engineering Mathematics, E.Kreyszig, John Wiley&Sons
4. Special Functions, E.D.Rainville, Chelsea Publication Co.
5. SpecialFunctionsforScientistsandEngineers,W.W.Bell,DoverPublications

B010702T: Atomic &Molecular Spectroscopy

Course Outcomes (COs):
After completion of this course ,a student will be able to: CO1: Understand Classical and Quantum models of atom. CO2: Learn different types of interactions in atom and their physical significance. CO3: Learn importance of molecular rotational and vibrational spectra. CO4: Distinguish among atomic, molecular and electronic structures and spectra.

UNIT-I

Quantum mechanical treatment of one electron atom, fine structure of hydrogen atom. Spectra of alkali elements, singlet and triplet states of He.

UNIT-II

Spin-orbit interaction, L-S and J-J coupling, Landeg-factor for L-Scoupling, L and e interval rules, selection rules, Intensity relations, Zeeman (Normal and anomalous), Paschen back and stark effects, hyperfine structure and isotopic shift, Lamb shift.

UNIT-III

Spectra of Diatomic Molecules Rotational Spectra (rigid rotator and non-rigid rotator model) Vibrational Spectra (harmonic and enharmonic model) Molecular Symmetric Top, Vibrating rotator Isotopic shift.

UNIT-IV

Raman Spectra (Quantum mechanical and classical approach) Electronic Spectra-vibrational structure of band system, fine structure of the band systems. Intensity distribution in band systems: Frank Condon principle.

Books for Study:

1. H. E. White, Introduction to Atomic spectra
2. C. N. Banwell, Fundamental of Molecular spectroscopy, TMH.
3. G.Herzberg, Atomic spectra & Structure
4. Bransden and Joachain, Physics of Atoms and Molecule
5. Raj kumar, Atomic &Molecular Spectroscopy
6. Gupta, Kumar &Sharma, Elements of Spectroscopy

Booksfor Reference:

1. J.M.Brown, Molecular spectroscopy
2. G.M.Barrow, Introduction to Molecular spectroscopy
3. P.F.Bemath, Spectra of Atoms and Molecule
4. B.P.Stranghan and S.Walker, Spectroscopy, Vol I, II and III.
5. G.K.Woodgate, Elementary atomic structure, Clare don Press.
6. M.Karplus, Atoms and Molecules, Benjamin-Cumming Pub. Co

B010703T:Quantum Mechanics

Course Outcomes (COs):
After completion of this course, a student will be able to: CO1:Students will be able to correlate the classical and quantum ideas. CO2: They will learn different representations used in quantum mechanics and their physical significance. CO3:They will learn importance of angular momentum observable in quantum mechanics. CO4:They will be able to know about time-independent perturbation theory and their applications.

UNIT-I

Basic formalism

Wave functions for a free particle- Interpretation and conditions on the wave function-Postulates of quantum Mechanics and the Schrödinger equation-Ehrenfest's theorem –Expectation Value-StationaryStates-HermitianOperatorsfordynamicalvariables-EigenvaluesandEigenfunctions -Uncertainty Principle.

UNIT-II

One Dimensional and Three-Dimensional Problems

One Dimensional: Particle in a box –simple harmonic oscillator –Square well potential –Barrier penetration – Three Dimensional: Orbital angular momentum and spherical harmonics - Central forces and reduction of two body problem - Particle in a Spherical well - Hydrogen atom.

UNIT-III

General formalism

Hilbert's space - Dirac notation - Representation theory - Co-ordinate and momentum represent at ions-Time evolution- Schrödinger, Heisenberg and Interaction pictures-Symmetries and conservation laws - Unitary transformations associated with translations and rotations.

UNIT-IV

Approximation methods

Time-independent perturbation theory for non- degenerate and degenerate levels – Application to ground state of an harmonic oscillator and Stark effect in Hydrogen .

References:

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

B010704T:Numerical Methods and C Programming

Course Outcomes (COs):
After completion of this course, a student will be able to: CO1:Conceptualize cause & consequence of errors in the application of computing. CO2: Numerical techniques for solving various problems. CO3:Applications of statistics &probability in real life domain. CO4:Learn statistical techniques through different tools and apply it to case studies using the concepts learned in the class. CO5:Able to understands the fundamentals of C programming and applications in problem solving. CO6:Able to apply control structures and use defined functions for solving the problem CO7: Able to apply the array for Strings and string handling operations. CO8:ApplyskillofidentifyingappropriateprogrammingconstructsforproblemSolving.

UNIT-I

ALGEBRAIC AND TRANSCENDENTAL EQUATIONS

The Iteration Method –Method of false position-Newton-Raphson method – Convergence of Newton-Raphson Method – Bisection method – Order of Convergence for N-R Method.

UNIT-II

INTERPOLATION

Linear Interpolation-Gregory-Newton forward and Backward Interpolation formula Central difference formula-Gauss forward and backward interpolation formula Lagrange's interpolation formula-Newton's formula for unequal Intervals.

UNIT-III

NUMERICAL DIFFERENTIATION AND INTEGRATION

Numerical Differentiation for solving first order differential equations:-Euler's method-Improved Euler's method -Runge-Kutta second and fourth order method for solving first order differential equations Numerical Integration: Trapezoidal rule-Simpson's 1/3rd rule-formula and derivation.

UNIT- IV

C PROGRAMS

Structure of a C program-Primary data types-Constants-Integers-Various types of operators and expressions- Control structure- if- if-else–go to–while–do,while–for statements- declaration and initialization of arrays(1-d,2-d)-Functions- Calling a function-Return values and their types. Development of C program for 1)Fitting a straight line, 2) Newton-Raphson method, 3) Lagrange's Interpolation 4)Euler's method, 5)R.K Second order, 6) Trapezoidal rule

BOOKS FOR STUDY

1. B.P.Flannery,S.A.Teukolsky,W.T.Vetterling,NumericalRecipesinC,W.H.Press, Cambridge University (1996).
2. M.K.Venkataraman,NumericalmethodsinScienceandEngineering,NationalPublishing Company, Chennai (2004).

3. E.Balagurusamy,ProgramminginANSI– C,TataMcGrawHillpublications(2004).

BOOKS FOR REFERENCE

1. S.S.Sastry, Introductory Methods of Numerical Analysis, PHI,NewDelhi(2003).
2. Numerical Methods in Science and Engineering –The National Publishing Co. Madras

B010705T:Lasers, Optical Fibers and Sensors

Course Outcomes (COs):

After completion of this course, a student will be able to:

1. Understand fundamental properties of LASERS and their operational principles.
2. Understand the operating principles and characteristics of Fiber Optics.
3. Understand and compare operating principles, characteristics of different Optical Fibers.
4. Understand fundamental theories, basic principles and components of optical fiber communication system.
5. Understand fundamental theories, basic principles and components of different types of SENSORS.

UNIT-I

LASERS,Concept of Population Inversion, Laser Pumping, Resonators, Ruby laser, Helium Neon laser,Semi conductor lasers, Liquid laser, Dye laser and Chemical laser,Properties of lasers,Lasers in Chemistry, Communication by Laser, Laser in Atmospheric Optics ,Laser in Astronomy, Laser in Biology, Laser in Medicine, Laser in Industry.

UNIT- II

Demands of Information Age, The promise of Optical information processing, Evolution of Fiber Optics, Optical fiber Communication System, Block diagram of Optical fiber Communication System, Light propagation through medium, Total internal reflection, Numerical Aperture, Acceptance Angle.

UNIT- III

The optical fiber, Structure and types of fiber, Single mode fiber, Multimode Fiber, Step-index fiber, Graded-index fiber, Attenuation loss, Fiber materials, Fabrication of Optical fibers, Mechanical Misalignment, Fiber joints and Couples, Fiber Splicing, Demonstration of fiber optic communication.

UNIT- IV

Optical Sensors, Advantages of optical Sensors, Properties of Sensors ,Sensors types, Biomedical Sensors, Chemical Sensors, Electrical and Magnetic Sensors, Rotation Sensors, Fiber-Optic Gyroscope, Sensors for structural health monitoring, Miscellaneous Sensors.

Reference Books:

1. Optical Fiber Communication Principle and Practice: JohnMSenior,PearsonEducation.
2. Optical Communication System: JohnGower,PrenticeHallof India
3. Fiber Optics Communication: Palais,UniversityPress
4. Introduction to Optical Fibers and its Applications:RajeshShuklaLAPLAMBERTAcademic Publishing
5. Nonlinear Fiber Optics : G.P.Agarwal,AcademicPress,SanDiegoCalifornia.
6. Laser :Eberly
7. Principles of Laser: Orazio Svelto,Springer
8. Introduction to Optics: Anchal Srivastavaetc,NewAgeInternationalPublishers,NewDelhi
9. Laser, theory and Applications: K.Thyagarajan

B010706P: Physics Lab-I

A. List of Experiments

1. To determine Planck's constant by photocell
2. Michelson Interferometer- Thickness of mica sheet.
3. Verification of Stefan's law for blackbody radiation
4. Determination of the velocity of Ultrasonic waves in solids/liquids.
5. Specific charge of an electron -Thomson's method/Magnetron method

B. Project Presentation/ Seminar on an assigned topic.

**Marks distribution:*

ETE:One practical– 50

CTE:Practical record(20)+Seminar (30)=50

B010707P: Electronics Lab-I

A. List of Experiments:

1. Study of Half/ Full Bridge rectifier circuits with filters.
2. Setting up a Power Supply using a Zener Diode as Voltage Regulator.
3. Study of Bipolar Junction Transistor Static Characteristics.
4. Study of CE, CB and CC configuration of BJT circuit.
5. Study of Field Effect Transistor Characteristics.

B. Project Presentation/Seminar on an assigned topic.

**Marks distribution:*

ETE:One practical– 50

CTE:Practical record(20)+Seminar (30)=50

Semester II

B010801T: Advanced Quantum Mechanics

Course Outcomes (COs):
After completion of this course, a student will be able to: CO1:They will be able to tackle time dependent perturbation theory and its applications. CO2:They will be able to understand relativistic quantum mechanics. CO3:They will be able to understand Dirac equation and its interpretation. CO4: They will be able to understand quantum representation of fields.

Unit-I

Perturbation Theory: Perturbed oscillator, First order Stark effect, Zeeman effect, Variation method: Basic principles, Applications to: One dimensional harmonic oscillator, Ground state energy of hydrogen atom, Ground state of helium atom, Time dependent perturbation theory, Emission and absorption of radiation, Spontaneous emission.

Relativistic Quantum Mechanism: **Unit-II**

Free particle Klein-Gordan equation, Charge and current densities, Minimal electromagnetic coupling, Dirac's relativistic equation, Covariant form of the Dirac's equation, Adjoint Dirac equation, Continuity equation.

Unit-III

Dirac equation:

Free particle solutions, Dirac and Feynman interpretation of negative energy states, Dirac equation in electromagnetic field and its non-relativistic reduction, Dirac's equation in accentual field: spin angular momentum, spin-orbit energy, the hydrogen atom.

Unit-IV

Quantization of Fields:

Single-particle and Many-particle Hilbert space, Fock Space, Introduction to second quantization, Occupation number representation, Creation and annihilation operators, Bosons. Representation of operators: Change of basis and the field operator, Representation of one-body and two-body operators. Applications of Second Quantisation.

References:

1. Quantum Mechanics by L.I. Schiff, Tata Mcgraw Hill Education Private Limited Tata Mcgraw Hill Education Private Limited (2010).
2. IntroductionTo Quantum Mechanics by DavidJ.Griffiths,Pearson (2005).
3. AdvancedQuantumMechanicsbyJ.JSakurai,Pearson (2005).
4. QuantumMechanics:TheoryAndApplicationsbyA.Ghatak,Macmillan India Limited (2004).
5. RelativisticQuantumFieldsbyJamesD.Bjorken,SidneyD.Drell,Doverpublications(2012)
6. AFirstBookOfQuantumFieldTheorybyALahiri,NarosaBookDistributorsPvtLtd (2005).

B010802T: Electrodynamics

Course Outcomes (COs):

After completion of this course, a student will be able to:

CO1:Students will be able to understand Poisson and Laplace equations.
CO2:They will learn different representations used in Electrodynamics and their physical significance.
CO3:They will learn the importance of EM Fields and their correlations with Maxwell's equations.
CO4:They will be able to understand the dynamics of charged particles in E.M. fields and various concepts of Plasma Physics.

UNIT-I

Electrostatics Differential equation for electric field, Poisson and Laplace equations, Boundary value problems, Solutions of Laplace equation in cylindrical and spherical coordinates by orthogonal functions, dielectrics, polarization of a medium, electrostatic energy.

UNIT-II

Maxwell's Equations Displacement current, vector and scalar potentials, gauge symmetry, Coulomb and Lorentz gauges, electromagnetic energy and momentum, conservation laws, in homogeneous wave equation and Green's function solution. Electromagnetic Waves Plane waves in a dielectric medium, reflection and refraction at dielectric interfaces, frequency dispersion in dielectrics and metals, dielectric constant and anomalous dispersion, wave propagation in one dimension, group velocity, metallic wave guides, boundary conditions at metallic surfaces, propagation modes in wave guides, resonant modes in cavities.

UNIT-III

Radiation Field of a localized oscillating source, fields and radiation in dipole and quadrupole approximations, antenna, radiation by moving charges, Lienard-Wiechert potentials, total power radiated by an accelerated charge, Lorentz formula.

UNIT-IV

Concepts of Plasma Physics Formation of plasma, Debye theory of screening, plasma oscillations, motion of charges in electromagnetic fields, magneto-plasma, plasma confinement, hydro magnetic waves.

References:

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

B010803T:Electronics

Course Outcomes (COs):
After completion of this course, a student will be able to: CO1:Thorough understanding of operational amplifiers. CO2:Design circuits using operational amplifiers for various applications. CO3:Explain the working and applications of Power Devices and Regulator Circuits. CO4: Design Oscillators and active filters using Op-Amps.

Unit-I

Operational Amplifier: Introduction to OP-Amp, Basic parameters, Applicability of OP-Amp in analog computation, OP-Amp as voltage follower, Adder, Substractor, Integrator, Differentiator, Log amplifier, Anti-log Amplifier, Analog multiplier & divider circuit. OP-Amp as Low pass filter, High Pass, Band pass filter and Band elimination filter.

Unit-II

Transistor Oscillators: Oscillator as positive feedback amplifier, Condition of sustained oscillations, Phase shift and Wein bridge Oscillator, Hartley & Colpits circuit, Negative resistance oscillator, Frequency stability & distortion in oscillators, Miller circuit.

Unit-III

Non Sinusoidal Generators : Multi vibrators, Bistable, Monostable and Astable Multivibrators, Saw tooth wave generators, Pulse generator, Clipping and Clamping circuits.

Unit-IV

Power Electronics:

Power Devices: SCR- basic structure, I-V characteristics and two transistor model, DIAC and TRIAC, Basic structure, Operation timer and equivalent I-V characteristics, TRIAC as high powers witch, DIAC as triggering device of TRIAC, UJT in over voltage protection, Sawtooth wave generation using UJT.

Regulator Circuits: Load and Line regulation, Stabilization ratio, Internal impedance and temperature coefficient of voltage regulation, Linear voltage regulation circuit.

Text and Reference Books:

1. Principle of electronics–VK Mehta
2. Switch model power conversion basic theory & design–Kitscem (MorcelDecnar,New York)
3. Power Electronics-PCSen (TataMcGrawHill)
4. Electronic Devices & Circuits -Millman&Halkias
5. Functional Electronics- RajaRaman

B010804T:Physics in DailyLife

Course Outcomes (COs):

This course is intended for students of disciplines other than Physics. The prerequisite of this course is the secondary level of knowledge in mathematics and physics. Through this course, students can appreciate their surroundings by understanding the basic rules of Nature and able to connect some daily life observations to Physics principles.

Unit-I

Units, Dimensions and Errors: Fundamental and derived quantities.Units and dimensions, dimensional analysis,order of magnitude,significant figures,errors.

Light: Reflection, refraction,diffraction, interference, scattering(elementary ideasonly)– examples from daily life–apparent depth, blue color of sky,twinkling of stars.

Total internal reflection, mirage, sparkling of diamond, primary and secondary rainbow – optical fibres. Concave and convex mirrors,lenses– focal length, power of a lens, refractive index, prism,dispersion.Human eye, defects of the eye– myopia, hypermetropia, presbyopia and a stigmatism and their correction by lens.

Unit-II

Motion:Velocity,acceleration,momentum,Idea of inertia,force - laws of motion. Newton's law of gravitation, acceleration due to gravity,mass and weight,apparent weight, weightlessness. Rotational motion,Moment of inertia, torque,centripetal and centrifugal acceleration examples-banking of curves, centrifugal pump etc.

Unit-III

Electricity: Voltage and current, ohms law.Electric energy, electric power, calculation of energy requirement of electric appliances– transformer,generator,hydroelectric power generation–wind power–solar power–nuclear power

Matter and energy: Different phases of matter, fluids- surface tension,viscosity-capillary rise, Bernoulli's theorem and applications.Heat energy, temperature, different temperature scales– degree Celsius, Fahrenheit and Kelvin.Waves– transverse and longitudinal waves, sound waves, Doppler Effect.Lasers, fluorescence, phosphorescence, electromagnetic waves – applications – microwave oven, radar, super conductivity.

Unit-IV

Universe: Planets,– solar system, moon-faces of moon, lunar and solar eclipses, constellations,Different types of stars, Galaxies,black hole. Satellites, Artificial satellites,Global positioning system.Geo stationary satellite.

Reference Texts

- Fundamentals of Physics with Applications by Arthur Beiser
- ConceptualPhysicsby Paul G Hewitt

B010805T:Home Appliances

Course Outcomes (COs):

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that a student can demonstrate the following industry-oriented COs with competency:

CO1:Troubleshoot different types of microphones and speakers.
CO2: Maintain audio systems.
CO3:Analyze the composite video signal used in TV signal transmission.
CO4: Trouble shoot colour TV receivers.
CO5:Maintain various consumer electronic appliances.

UNIT -I

CAUTION PRACTICED IN ADVANCE : Electricity – Basic principles - Practical unit of electricity- Electric shock– Precautions to avoid electric shock– Rescue steps in electric Shock - Electric Line Circuit Breaker (ELCB).

WIRING : Wiring system – Electric supply to house and factories – Types of wiring– ISI Rules –Meggertesting–Earthing.Electricity in house: Design for heating element–Electric iron,Table heater, Hot plate and Room heater.

UNIT-II

ELECTRICAL MEASURING INSTRUMENTS : Moving coil instruments– Voltmeter – Ammeter – Wattmeter– Kilowatt meter– Frequency meter– Multimeter.

UNIT-III

ELECTRICAL APPLIANCES : Electric fan – Refrigerator – Air Conditioner – Air cooler. Electric bell – Buzzer -Washing machine

UNIT-IV

LIGHT : Incandescent lamp – Fluorescent lamp – LED lamp - Solar powered street lights. COURSEOUTCOME:Under stand the working principles and applications of latest Appliances.

TEXT BOOKS:

1. A.L.AnwaniandI.Anwani,BasicElectricalEngineering,DhanpatRaiandCo(P)Ltd.,Delhi, 2003. (Units 1to 5)
2. William D.Cooper, Electrical Instuments and Measurement Techniques, PHI Pvt Co., New Delhi, 1997. (Units 2,3&4)
3. S.P.Bali,ConsumerElectronics,PearsonEducation,India,2005.
4. B.L.Theraja,Text book of Electrical Technology, Vol.1 & 2, S. Chand, 2

B010806P: Physics Lab-II

A. List of Experiments

1. To determine laser beam parameter
2. Characteristics of Solar cell
3. Study of Hall's effect in a given semiconductor.
4. Resistivity measurement of a semiconductor by Four–Probe method
5. Determination of e/m by Millikan's Oil drop method

B. Industrial Training (10 days Teaching/Research/Social work/other related Training)

**Marks distribution:*

ETE: One practical– 50

CTE:Practical record (20) + Industrial Training *(30)= 50*

B010807P: Electronics Lab-II

A. List of Experiments

1. Study of Op-amp -Basic operational circuits.
2. A stable and mono stable multi vibrators using IC 555.
3. Characteristicsof SCR.
4. Characteristicsof LDR.
5. Up/down counter using mod10

B. Industrial Training (10 days Teaching/Research/Social work/other related Training)

**Marks distribution:*

ETE: One practical– 50

CTE: Practical record (20) + Industrial Training *(30)= 50*

SEMSETER-III

B010901T:NuclearPhysics

Course Outcomes (COs):
After completion of this course, a student will be able to: CO1: Understand about nature of nuclear forces. CO2: Know different types of Nuclear models. CO3:Know different kinds of nuclear reactions tanking place in our surroundings. CO4:Understand different kinds of elementary particles, their interaction and classification.

Unit-I

Binding Energy

Basic properties of nuclei, nuclear stability, nuclear size by electron scattering.

Nuclear Forces:

Ground state of deuteron, n-p scattering, analysis by method of partial wave, effective range theory, p-p scattering, charge independence and charge symmetry. Non-central forces, exchange forces, isospin and charge independence, Pion theory of nucleon forces (elementary treatment).

Unit-II

Nuclear Models :

Liquiddrop model,Single particle model of nucleus, shell model, Magic numbers, magnetic moments and Schmidt lines, Collective model (qualitative discussion).

Nuclear reactions:

Concept of scattering and absorption cross sections,Partial wave analysis, Optical theorem, Compound nucleus, Breit- Wigner formula, Direct reaction , kinematics of nuclear reactions.

Unit-III

Nuclear Decay:

α-decay and Geiger-Muller law, Gammow's theory, β-decay – parity violation, selection rules, Fermi theory, Fermy-Curie plots, Comparative half life, -decay-multipole radiation, selection rules, photo disintegration of deuteron.

Unit-IV

Particle Physics:

Concept of elementary particles, Basic idea of fundamental interactions in nature, classification , conservative laws,Invariance associated production,strange particles,Quark model, Gell-Mann-Nishijima formula, symmetry transformation.

Reference Books:

1. Atomic&Nuclear Physics-SNGhosal
2. NuclearPhysics-DCTayal
3. NuclearPhysics-Royand Nigam
4. NuclearPhysics-Berkhum

B010902T:StatisticalPhysics

Course Outcomes (COs):
After completion of this course, a student will be able to: CO1:They will know about different types of ensembles CO2:They will understand about different types of distribution functions and their applications. CO3:They will know about different types of Quantum Statistics. CO4:They will come to know about diffusion and Brownian motion also.

Unit-I

Introduction to statistical physics: Phase space and phase space trajectory,concept of a statistical ensemble, distribution function, mean value of a physical quantity, statistical equilibrium, statistical independence and quasi-closed systems. Liouville's theorem (no derivation) and its significance, thermodynamic potential: Helmholtz and Gibb's potentials, first and second order phase transitions

Unit-II

Ensemble Theory: Concept of ensembles: micro canonical, canonical and grand canonical ensembles. Microcanonical distribution in classical statistics. Gibb's canonical distribution. Partition function, grand canonical distribution, free energy and equation of state of an ideal gas, chemical potential of a mono atomic ideal gas. Statistical distribution in quantum statistics.

Unit-III

Quantum statistics: Fermi-Dirac and Bose-Einstein distribution, F-D and B.E gases of elementary particles. The electron gas in metals, Degenerate electron gas-equation of state, degeneracy temperature, specific heat. Degenerate Bose Gas, Specific heat and pressure, B-E condensation, Ising model, Diffusion equation

Unit-IV

Fluctuations: Fluctuations in ensemble, correlation of space-time dependent fluctuations, fluctuations and transport phenomenon, Brownian motion, Langevin theory, fluctuation dissipation theorem, Fokker-Plank equation.

Reference Books:

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

B010903T:Materials:Introduction, Synthesis and Processing Course

Outcomes (COs):

After completion of this course, students will be able to:

CO1:Students will be able to understand the types of materials.
CO2:They will earn different approaches used in Synthesis of materials.
CO3: They will learn use and importance of different type of materials.
CO4:Theywillbeableunderstandvariouscharacterization techniques.

Unit-I

Introduction to materials: Metal and alloy, ceramics, Composites Nano-materials and bio materials, etc. Ceramic powder synthetic methods: Diffusion; (Laws of diffusion, types of diffusion, Fick's Law, diffusion in ionic solids, Role of diffusion in solid state reactions and sintering), Solid State reaction method.

Unit-II

Synthesis of Materials: Chemical reduction, Reaction in micelles, emulsions and dendrimers, Photo chemical and radiation chemical reduction, Cryo chemical synthesis, Sono chemical methods and Physical methods, chemical methods, Co-precipitation, Spray drying, Freeze drying, Sol-gel method, Hydro thermal, Combustion and Microwave synthesis.

Unit-III

Biomaterials: Biocompatibility, Bonecomposition, and properties, Hydroxyapatite and calcium phosphate biomaterials, Bio ceramics, Bio glasses and bio compatible polymer materials

Unit-IV

Characterization Techniques: XRD-X-ray Diffraction, X-ray Photo electron Spectroscopy (XPS), Scanning Electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic Force microscopy (AFM), Thermo Gravimetric analysis (TGA), Differential thermal analysis, (DTA), differential scanning calorimetry, Raman Spectroscopy, Photo luminescence Spectroscopy (Only Introductory)

Text and References Books

1. V.Raghvan,Materials Science and Engineering: A First Course
2. W.D.Callister, Materials Science and Engineering: An Introduction
3. P.K.Ghosh, Introduction to Photo electron Spectroscopy
4. R.Egerton, Physical Principles of Electron Microscopy
5. D.B.Williams,C.Barry Carter, Transmission Electron Microscopy:A text book for Materials Science.

B010904T: Optoelectronics and Optical Communication

Course Outcomes (COs):
After completion of this course, a student will be able to: CO1:Understand fundamental properties of light and operation principles of basic optical components. CO2:Understand the operating principles and characteristics of optical sources. CO3: Understand and compare operating principles, characteristics of optical detectors CO4:Understand fundamentals theories, basic principles and components of Optical fiber communications.

Unit-I

Light Emitting Diodes: Structures, light source materials, Quantum Efficiency on LED Power modulation of a LED, Lasers, Theory of Stimulated emission, Principle of laser action, types of lasers, Laser diodes, characteristics of semiconductor lasers and LEDs.

Unit-II

Optical detector principle, characteristics of photo detector absorption coefficient, detector, characteristics, Quantum efficiency, responsivity, PN junction-photo diode, P-I-N photo diode, avanlche photodiodes, Noise in Photo detectors, Photo conductors.

Unit-III

Differentgenerationsofopticalfibercommunicationsystems,Optical fiber structure,Propagation of light -total internal reflection, acceptance angle and numerical aperture, step-index, Graded index, Single and Multimode fibers

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Unit-IV

Transmission characteristics of optical fibers – Signal degradation in optical fibers; Attenuation, Dispersion and pulse broadening in different types of optical fibers, fiber splicing, fiber connectors, connection losses, fiber couplers.

Reference Books:

1. JohnM.Senior,Optical Fiber Communications; Principles and Practice
2. GerdKeiser,Optical Fiber Communication
3. DjafarKMynbaev &Lowell LScheiner,Fiber Optic Communications Technology
4. J.Gowar,Optical Communication systems

B010905T:Renewable Energy Resources

Course Outcomes (COs):

After completion of this course, a student will be:

C01:Able to understand the renewable energy sources available at present.

C02:Able to understand the solar energy operation and its characteristics.

C03: Able to understand the wind energy operation and its types.

C04:Able to understand the tidal and geothermal energy principles and its operation.

Unit-I

Conventional Energy Sources, Non-Conventional Energy Sources, Renewable Energy Potential.

Solar Energy: Solar radiation Availability, Instruments for measurement of Solar Radiation,Solar angles, Atmospheric phenomena, Solar Collectors (FPC, ETC and PTC), Solar thermal and PV applications: water heating application, Solar Dryer, Solar distillation, Solar refrigeration and Fundamental of Photovoltaic.

Unit-II

Hydro power Energy: Magneto-hydro-dynamic (MHD) system, Ocean thermal energy conversion (OTEC), Tidal energy conversion, Spring and neap tides, Single and double basin system, Geothermal Energy, Types of geothermal energy sites, Geothermal power plants.,

Unit-III

Bio-Energy:Biomass availability, Technologies for Bioenergy conversion, Global and Indian Bio Energy Potential, Nuclear Energy.

Unit-IV

Wind Energy: Fundamental of Wind Energy, Indian Wind Energy Potential, Types of wind turbine, Characteristics of the wind, Wind speed monitoring instruments and applications.

TEXTBOOKS

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

B010906P:PhysicsLab-III

A. List of Experiments

1. To study Zeeman effect and to determine the splitting of spectral lines
2. G.M.Counter-Absorption coefficient.
3. To determine paramagnetic susceptibility of given material (solution)
4. Study of Iodine absorption spectrum.
5. Study of Mercury spectrum using Grating Spectrometer

B. Project Presentation/ Seminar on an assigned topic.

*Marks distribution:

ETE: One practical –50

CTE: Practical record (20) + Seminar (30) = 50

B010907P: Electronics Lab-III

A. List of Experiments:

1. Study and Verification of Basic and Universal gates.
2. Design & Implementation of half and full adder using XOR& NAND gates
3. Realization of SR, JK, D and T flip-flops.
4. Design and implementation of comparator using logic gates and IC7485.
5. Microprocessor kit:

   (a) Hard ware familiarization

   (b) programming for (i) addition and subtraction of numbers using direct and indirect addressing modes (ii) Handling of 16 bit numbers (iii) use of CALL and RETURN instructions and block data handling.

B. Project Presentation/ Seminar on an assigned topic.

**Marks distribution:*

ETE: One practical– 50

CTE: Practical record(20)+Seminar (30)=50

B011001T: Condensed Matter Physics

Course Outcomes (COs):
After completion of this course, a student will be able to: CO1:They will have clear under standing about structure and structure-related properties of solids. CO2:They will understand different models of solids and about superconductors. CO3: They will understand about different parameters of dielectrics. CO4:They will gain knowledge about different types of dielectric materials and about ferromagnetic materials.

Unit-I

Lattice Dynamics:

Central and non-central forces, Generalized force constants, Harmonic approximation, three dimensional lattice, Dielectric constants, source of polarizability and Clausius-Mossoti relation, introduction to liquid crystals-sematic and nematic, principle uses of liquid crystals (qualitative).

Unit-II

Electron Band Theory:

Bloch theorem, one electron band theories, plane wave like localized wave functions, nearly free electron approximation, linear combination of atomic orbitals (LCAO) method, tight binding approximation.

Unit-III

Superconductivity:

Persistent current, Meissner effect, Isotopic effect, Type-I and type-II superconductors,electronic specific heat, London's equation, simple idea about screened Coulombian interaction.

Cooper pairs, elementary idea about BCS theory, Ground state energy, Superconducting tunneling, Josephson effect.

Unit-IV

Magnetism:

Paramagnetism, molecular field theory of ferromagnetism, exchange interaction between spins, ferromagnetic and anti-ferromagnetic order, neutron diffraction method to obtain magnetic order in ferromagnetic and anti-ferromagnetic cases of ferroelectricity.

Lattice defect:

Point defect, Frenkel and Schottky defect, color centres, number of defects (vacancies) in equilibrium,dislocation edge and screw, Burger vector, role of dislocation in material strength and crystal growth.

ReferenceBooks:

1. Solid State Physics-C.Kittle
2. Quantum theory of Solids-C Kittle
3. Theoretical Solid State Physics-Wuang
4. Solid State Physics-SO Pillai
5. Mossbauereffect and its application–VGBhinde
6. Semiconduct or Physics-SMSze

B011002T: Communication and Microwave Electronics

Course Outcomes (COs):

After completion of this course, a student will be able to:

1. Able to understand the basic concepts of analog communication system and analyze the various Amplitude modulation, Frequency and Phase modulation schemes.
2. Able to describe and analyze the various pulse modulation and multiplexing techniques for the digital transmission of analog signal.
3. Able to identify and describe different techniques in modern digital communications.

Unit-I

Analog and Digital Communication: Different type of modulation, Amplitude modulation, Depth of modulation, Frequency spectrum, Square law modulation, Balanced modulator,DSBSC modulation, SSB modulation, Frequency modulation, Reactance tube modulation, Detection of AM and FM waves, linear diode detector, Foster- Shelley discriminator and ratio detector, Fundamentals of PAM, PAW & PPM.

Unit-II

Microwave Devices: Klystron,Reflex-Klystron,Principles of operation of Magnetrons, traveling wave tubes, Gunn diode.

Microwave Communication: Advantages and disadvantages of microwave transmission lines in free space, Propagation of microwaves,Atmospheric effects on propagation, Antennas used in microwave communication.

Unit-III

RadioandTelevisionReceivers:TRFand superheterodynereceiver, blockdiagramofB&W T.V.Transmitterandreceiver.

Satellite Communication: Fundamental principle of satellite communication, Communication satellite link design, Satellite orbit inclination, basic elements of RADAR system.

Unit-VI

Optical Communication: Introduction to optical fiber, ray transmission step index, Grounded index,Single mode and multi-mode, Fundamental of LED optical propagation theory, basic idea of optical detectors.

Reference Books:

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

B011003T:Digital Electronics and Microprocessor

Course Outcomes (COs):

The objective of the course is to introduce basic semiconductor devices, their characteristics and applications, to understand the analysis and design of simple diode circuits, learn to analyze the PN junction behavior at the circuit level and its role in the operation of diodes and active devices.
After completion of this course, a student will be able to:

1 Acquireknowledgeabout8085Microprocessorandsupportingdevices.

2 Writetheassemblylanguageprogrammingusing 8085microprocessors.

Unit-I

Number systems, Code (Grey code, ASCII code & BCD code),Basic logic gates,DTL,RTLTTL & ECL logic circuits, Analysis and synthesis of combinational logic circuits, Karnaugh map, Pairs, Quad & Octets.

Unit-II

Arithmetic logic circuits, Controlled inverter and adder substractor circuits, Data processing circuits, Multiplexers, Demultiplexers, Encoder & Decoder, (1 of 16 decoder, BCD decoder & LED decoder)

Unit-III

Introduction to FF, R-S, D, T, J-K and J-K master slave FF, Synchronous and asynchronous counters, Mode counters, Ring counter, Serial and parallel shift registers.

Introduction to semi conductor memories, RAM, ROM, EPROM and their addressing techniques, A/D and D/A converter, 555 timer and its application as mono stable , astable and multivibrator.

Unit-IV

Microprocessor Architecture & programming:

Introduction to microprocessor, Architecture of 8085 system components, Control signal of 8085, System timing diagram, Memory R/W cycle, instruction set of 8085, Addressing modes, Elementary programming , concept of8085 M.P.

DataTransfer Scheme & Memory Interfacing:

Data transfer scheme in microprocessor, Memory mapped I/O and I/O mapped, I/O scheme synchronous, Asynchronous & interrupts driven schemes, Hardware and software interrupts of 8085, Concept of memory & I/O interfacing of DMA, Controller.

Text and References Books

6. Digital principle and application- Malvinoand Leach
7. Modern digital electronics-RP Jain
8. Microprocessor-Gaonkar
9. Microprocessor and interfacing-DouglasHall

B011004P: Physics Lab- IV

A. List of Experiments

1. Co-efficient of linear expansion-Air wedge method.
2. Susceptibility of a liquid by Quincke's method
3. B-H curve using CRO
4. Study of Electron Spin Resonance in crystals and determination of'g'factor
5. Determination of bulk modulus of a liquid using ultrasonic interferometer.

B. Industrial Training (10 days Teaching/Research/Social work/other related Training)

**Marks distribution:*

ETE: One practical– 50

CTE:Practical record (20) + Industrial Training *(30)= 50*

B011005P:Electronics Lab-IV

A. List of Experiments

1. Design and study of amplitude modulation and demodulation circuits
2. Design and study of pulse width modulation and demodulation circuits
3. Wave form analysisusing storage CRO
4. Study of reflex klystron characteristics
5. Studyof Gunn diode characteristics and PIN modulator

B. Industrial Training (10 days Teaching/Research/Social work/other related Training)

**Marks distribution:*

ETE: One practical – 50

CTE: Practical record (20) + Industrial Training *(30)= 50*

B011006P:Major Research Project/Dissertation

Preamble

The concept of introducing the project will help the student community to learn and apply the principles of Physics and explore the new research avenues. In the course of the project the student will refer books, Journals or collect literature / data by the way of visiting research institutes/ industries. He/she may even do experimental /theoretical work in his/her college and submit a dissertation report with a minimum of 40 pages not exceeding 50 pages.

Format for Preparation of Dissertation

The sequence in which the dissertation should be arranged and bound should be as follows:

1. Cover Page and title Page
2. Declaration
3. Certificate
4. Abstract (not exceeding one page)
5. Acknowledgement(not exceeding one page)
6. Contents(12 Font size, Times new Roman with double line spacing)
7. List of Figures/Exhibits/Charts
8. List of tables
9. Symbols and notations
10. Chapters
11. References