POST GRADUATE DEPARTMENT OF PHYSICS

UNIVERSITY OF KASHMIR, SRINAGAR

Choice Based Credit System

Course Curriculum (Syllabus for Examination)

For the Academic Years
2015, 2016 &
2017

Summary of all the courses

Semester – I				
Course Type	**Course Code**	**Title of the Course**	**No. of Credits**	**Teacher**
Core (CR)	PHY15101CR	Mathematical Physics – I	04	
	PHY15102CR	Quantum Mechanics – I	04	
	PHY15103CR	Lab. Course	04	
Discipline Centric Electives (DCE)	PHY15104DCE	Classical Mechanics	04	
	PHY15105DCE	Antenna and Wave Propagation	04	
	PHY15106DCE	Electronics – I	02	
Generic Electives (GE)	PHY15107GE	Physics Education	02	
	PHY15108GE	Introduction to Astronomy	02	
	PHY15109GE	Philosophical foundations of Quantum Mechanics	02	
Open Electives (OE)	PHY15110OE	Biophysics	02	

Semester – II				
Course Type	**Course Code**	**Title of the Course**	**No. of Credits**	**Teacher**
Core (CR)	PHY15201CR	Statistical Mechanics	04	
	PHY15202CR	Electrodynamics – I	04	
	PHY15203CR	Lab. Course	04	
Discipline Centric Electives (DCE)	PHY15204DCE	Mathematical Physics – II	04	
	PHY15205DCE	Quantum Mechanics – II	04	
	PHY15206DCE	Advanced Digital Systems	02	
Generic Electives (GE)	PHY15207GE	Tensor Analysis	02	
	PHY15208GE	Crystallography	02	
	PHY15209GE	Electronics – II	03	
Open Electives (OE)	PHY15210OE	Renewable Energy Resources	02	
	PHY15211OE	Philosophical Foundations of Physics	02	

Semester – III

Course Type	Course Code	Title of the Course	No. of Credits	Teacher
Core (CR)	PHY15301CR	Nuclear Physics	04	
	PHY15302CR	Condensed Matter Physics	04	
	PHY15303CR	Atomic and Molecular Physics	04	
Discipline Centric Electives (DCE)	PHY15304DCE	Astrophysics – I	03	
	PHY15305DCE	Electrodynamics – II	03	
	PHY15306DCE	Field Theory – I	03	
	PHY15307DCE	Seminar/Oral presentation/Demonstration	02	
Generic Electives (GE)	PHY15308GE	Microwave Devices and Circuits	02	
	PHY15309GE	Advanced Lab. Methods	02	
	PHY15310GE	Superconductivity	02	
Open Electives (OE)	PHY15311OE	Lasers	02	
	PHY15312OE	Radioactivity and Environmental Radon	02	

Semester – IV				
Course Type	**Course Code**	**Title of the Course**	**No. of Credits**	**Teacher**
Core (CR)	PHY15401CR	Particle Physics	04	
	PHY15402CR	Physics of Nano-materials	04	
	PHY15403CR	Computational Methods in Physics	04	
Discipline Centric Electives (DCE)	PHY15404DCE	High Energy Physics	02	
	PHY15405DCE	Astrophysics – II	03	
	PHY15406DCE	Field Theory – II	03	
	PHY15407DCE	Project	04	
	PHY15408DCE	Neutrino Physics	02	
Generic Electives (GE)	PHY15409GE	Density Functional Theory	04	
	PHY45410GE	Atmospheric Physics	04	
	PHY15411GE	Bose-Einstein Condensate	02	
Open Electives (OE)	PHY15412OE	Modern Communication Systems	02	
	PHY15413OE	Astronomical Techniques	02	

SEMESTER – IV

Semester – IV				
Course Type	**Course Code**	**Title of the Course**	**No. of Credits**	**Teacher**
Core (CR)	PHY15401CR	Particle Physics	04	
	PHY15402CR	Physics of Nano-materials	04	
	PHY15403CR	Computational Methods in Physics	04	
Discipline Centric Electives (DCE)	PHY15404DCE	High Energy Physics	02	
	PHY15405DCE	Astrophysics – II	03	
	PHY15406DCE	Field Theory – II	03	
	PHY15407DCE	Project	04	
	PHY15408DCE	Neutrino Physics	02	
Generic Electives (GE)	PHY15409GE	Density Functional Theory	04	
	PHY45410GE	Atmospheric Physics	04	
	PHY15411GE	Bose-Einstein Condensate	02	
Open Electives (OE)	PHY15412OE	Modern Communication Systems	02	
	PHY15413OE	Astronomical Techniques	02	

Semester IV

Particle Physics

Course No: **PHY15401CR**	Max. Marks:	100
	External Examination:	80
No. of credits: **04**	Internal Assessment:	20

UNIT – I

Overview of Elementary particles: Overview of particle discoveries, particle classification schemes, the Gellmann-Nishijima scheme, the eight fold way, the quark model.

Invariance principles and conservation laws: the parity operation, parity of particles and antiparticles, tests of parity conservation, charge conjugation invariance, charge conservation and gauge invariance, baryon and lepton conservation, CPT invariance, CP violation.

UNIT – II

Weak Interactions: V-A theory, coupling constant, neutron decay, muon decay, pion decay, CP invariance and violation, Charged weak interactions, neutral weak interactions, Cabibo mixing, CP violation; the neutral kaon system.

Electroweak Interactions: prediction and discovery of W /Z , weak isospin and hypercharge, the basic electroweak interaction, the effective current-current interaction, Feynman rules for electroweak interaction, Electron-positron annihilation

UNIT – III

Quark structure of hadrons: the baryon decouplet, quark spin and colour, the baryon octet, magnetic moment of baryons, the light pseudoscalar mesons, the light vector mesons, mesons built of heavy quarks.

Lepton and quark scattering: electron positron annihilation to hadrons. electron-muon scattering, neutrino-electron scattering, lepton-nucleon scattering, deep inelastic scattering and quarks.

UNIT – IV

Strong Interactions: the evidence for quarks and colour charge, strange particles, strongly decaying resonances.

Standard model: particle content of the Standard Model, nature of fundamental interactions, Inadequacies of SM, unification of electroweak and strong interactions

Text Books:

1. Introduction to Elementary Particles by David Griffiths (John Wiley & Sons).
2. Quarks and Leptons by Francis Halzen and Alan D. Martin (John Wiley & Sons).

Reference Books:

1. Introduction to High Energy Physics by D. H. Perkins

Semester IV

Physics of Nano-materials

Course No: **PHY15402CR**	Max. Marks: 100
	External Examination: 80
No. of credits: **04**	Internal Assessment: 20

UNIT – I

Introductory aspects: Free electron theory and its features, Idea of band structure of metals, insulators and semiconductors. Density of state in bands and its variation with energy, Effect of crystal size on density of states and band gap. Examples of nanomaterials

UNIT – II

Preparation of Nanomaterials and General Characterization Techniques. Bottom up: Cluster beam evaporation, ion beam deposition, chemical bath deposition with capping techniques and Top down: Ball Milling

Determination of particle size, study of texture and microstructure, Increase in x-ray diffraction peaks of nanoparticles, shift in photo luminescence peaks, variation in Raman spectra of nanomaterials, photoemission microscopy, scanning force microscopy

UNIT – III

Quantum Dots: Electron confinement in infinitely deep square well, confinement in one and two-dimensional wells, idea of quantum well structure, quantum dots – single and interacting quantum dots, self organized quantum dots, spectroscopy of quantum dots

UNIT – IV

Other Nanomaterials: Properties and applications of carbon nanotubes and nanofibres, Nanosized metal particles, Nanostructured polymers, Nanostructured films and Nano structured semiconductors.

Text & Reference Books:

1. Nanotechnology - Molecularly Designed Materials : G.M. Chow & K.E.Gonsalves (American Chemical Society).
2. Nanotechnology Molecular Speculations on Global Abundance : B.C. Crandall (MIT Press).

Reference Books:

1. Quantum Dot Heterostructures: D. Bimerg, M. Grundmann and N.N. Ledentsov (Wiley).
2. Nanoparticles and Nanostructured Films–Preparation, Characterization and Application : J.H. Fendler (Wiley).

Semester IV

Computational Methods in Physics

Course No: **PHY15403CR**	Max. Marks:	100
	External Examination:	50
No. of credits: **04**	Internal Assessment:	50

UNIT – I

Computers, Interpreters and Operating system, Types of programming languages, C programming, Programme Characteristics, C character set, identifiers and key words, Data types, Constants, Variables and Arrays Declaration, Expressions, Statements, Symbolic constants, Operators and Expressions, Library functions, Data input and output, Error Diagnostics, Debugging Techniques, Control statements, Case studies, Programming exercises

UNIT – II

Arrays, Character Arrays and Strings, User defined functions, Function properties, Recurrsion, Programme Structure, Structure and Unions, Pointers, Pointer Declaration, Operation on pointers, Pointers and one dimensional arrays, Arrays of pointers, User defined data types, File management in C, Preprocessor, Guidelines for developing a C programme, Case studies, Programming exercises

UNIT – III

Developing algorithms and Computer programs in C-Language to solve following problems:

(1) Linear Equations
(2) Non-Linear Equations
(3) Matrix Inversion
(4) Eigen-Values and Eigen-Vectors

UNIT – IV

Developing algorithms and Computers programs in C-Language to solve following problems:

(1) Interpolation with equally spaced and unequally spaced points
(2) Cubic Spline fitting
(3) Numerical Differentiation and Integration
(4) Second order differential equation by Runge-Kutta method and

other methods

Text Books:

1. Sastry: Introductory Methods of Numerical Analysis
2. Rajaraman: Numerical Analysis
3. Press, Teukolsky Vetterming and Flannery: Numerical Recipes
4. Balagurusamy: Programming in ANSI C

Reference Books:

1. Rajaraman: Numerical Analysis

Semester IV

High Energy Physics

Course No: **PHY15404DCE**	Max. Marks:	50
	External Examination:	40
No. of credits: **02**	Internal Assessment:	10

UNIT – I

Quarks and leptons:

Particle Classification: femions and bosons, Standard model of Particle Physics, Particles and antiparticles, Free particle wave equation, Lepton flavours , Quark flavours.

Interactions and fields: Classical and quantum picture of Interactions, Yukawa theory of quantum exchange, Feynman diagrams, Electromagnetic Interaction, Weak Interaction, Strong Interaction.

Invariance Principles, Conservation laws and Quarks in Hadrons:

Parity Operation, Test of Parity conservation, Charge conjugation Invariance, Baryon and Lepton conservation, Isospin in pion-nucleon systems, The baryon decuplet, The baryon octet, Light vector mesons, Mesons built of light and heavy quarks.

UNIT – II

Quark Interactions and QCD:

Elastic lepton-nucleon scattering, Deep Inelastic scattering, QCD potential at short distances, QCD potential at large distances.

Experimental Methods: Accelerators, Colliding beam accelerators, Accelerator complexes, Secondary particle spectators, Interaction of charged particle and radiations with matter, Shower detectors and calorimeters.

Quark Gluon Plasma and Signatures of Quark Gluon Plasma:

Quarks and Gluons, Bag model of hadrons, Quark Gluon Plasma, Quark Gluon Plasma at High Temperature, Quark Gluon Plasma with High Baryon Density, J/Psi suppression and production in Quark Gluon Plasma, Dilepton production in QGP, Photon production on Quark Gluon Plasma, Experimental information on J/Psi production and suppression, Experimental information on photon production.

Text Books:

1. Introduction to High Energy Heavy Ion Collisions by CHeuk-Yin Wong.

Reference Books:

1. Introduction to High Energy Physics by D. H. Perkins

Semester IV

Astrophysics - II

Course No: **PHY15405DCE**	Max. Marks:	75
	External Examination:	60
No. of credits: **03**	Internal Assessment:	15

UNIT – I

Stellar dynamics, types of forces on a star in the stellar system, Tidal radii, star star encounter, time of relaxation determination of time of relaxation, application to Galaxy & star cluster. Masses of double galaxies, Masses of cluster of galaxies by virial theorem observational determination of masses, clusters of galaxies, Missing mass problem.

UNIT – II

Cosmology, cosmological principle, Newtonian cosmology, deceleration parameters critical density, Robertson walker equation and its properties, solution of Robertson-Walker equations. Einstein field equation in cosmology, Energy tensor of Universe, solution of Friedman's equation, Einstein de-sitter model, open model, particle horizon, Event horizon.

UNIT – III

Thermal History of the Universe, Temperature red shift relation, distribution in the early Universe, relativistic and non-relativistic limits, decoupling of matter and radiation, Cosmic microwave background radiation (CMBR), isotropy and an-isotropy of CMBR.

UNIT – IV

Thermal History of the Universe, Temperature red shift relation, distribution in the early Universe, relativistic and non-relativistic limits, decoupling of matter and radiation, Cosmic microwave background radiation (CMBR), isotropy and an-isotropy of CMBR.

The formation of structures in the Universe: Jean's equation derivation from fluid dynamics and General relativity; evolution of Jean mass, Growth in the Post recombination era

Text Books:

1. Introduction to Cosmology By J.V.Narliker

2. Modern Astrophysics by B.W.Carroll and D.A.Ostlie, Addison-Wesley Publishing Co.

Reference Books:

1. Structure Formation in the Universe by T. Padmanabhan, vambridge University
2. Stellar Dynamics by S.Chandersakher
3. Stellar Evolution by Kippenhahn
4. Quassars and Active Galactic Nuclei by A.K.Kembehavia & G.V.Narliker, Cambridge University Press

Semester IV

Field Theory - II

Course No: **PHY15406DCE**	Max. Marks:	75
	External Examination:	60
No. of credits: **03**	Internal Assessment:	15

UNIT – I

Quantization of the electromagnetic field : Classical theory of electromagnetic fields. Problems with quantization. Propagator. Fourier decomposition of the field. Physical states. Feynman rules for photons. Quantum electrodynamics, Local gauge invariance. Interaction Hamiltonian, Lowest order processes. Electron-electron scattering, Electron-positron scattering . Consequence of gauge invariance. Compton scattering , Scattering by an external field. Bremsstrahlung.

UNIT – II

P, T, C and their combinations : Motivations from classical physics . Parity, Charge conjugation and Time reversal for free and interacting fields. CP and CPT.

Symmetries and symmetry breaking : Classification of symmetries, Groups and symmetries , Symmetry group. Examples of continuous symmetry groups , Generators of continuous groups, Representations , Approximate symmetries. Spontaneous breaking of symmetries , Discrete symmetry . U(I) symmetry, Non-Abelian symmetry, Goldstone's theorem. Higgs mechanism .

UNIT – III

Electromagnetic form factors: General electromagnetic vertex, Physical interpretation of form factors . Anomalous magnetic moment of the electron , Charge form factor. Electron- proton scattering . Renormalization : Degree of divergence of a diagram , Vertex function. Regularization of self-energy diagrams , Counterterms . Vertex function, Full Lagrangian. Specific examples in QED , Ward-Takahashi identity . Observable effects of renormalization , Running coupling constant. Cancellation of infra-red

divergences.

Text Book:

1. A First book of quantum field theory: Lahiri and Pal (Narosa Publishing House)

Reference Books:

1.Bjorken & Drell, Relativistic Quantum Fields.

2. Itzkyson & Zuber: Quantum Field Theory.

3.Bogoliubov & Shirkov: Introduction to the theory of Quantized Fields.

4. Weinberg, S. : The Quantum Theory of Fields, Vol. I

5. Schroeder & Peskin: Quantum Field Theory

Semester IV

Project

Course No: **PHY15407DCE**	Max. Marks:	100
	External Examination:	50
No. of credits: **04**	Internal Assessment:	50

Description

The students will work intensively on a topic of her/his choice, while interacting on regular basis with the project supervisor. The project should consist of any innovative topic in Physics which, in principle, should lead to some training for further research on the topic. The student should present the most recent and novel research happenings in the field.

The curriculum shall consist of the preparation and submission of a project report and then oral presentation and viva-voce before a committee consisting of internal and external examiners. The distribution of marks for the various component of this curriculum shall be as follows;

Total Marks:	100
Internal assessment (by the project supervisor):	20
Marks for the content of the Project Report:	30
Marks for oral presentation and viva-voce (external examiner):	50

Semester IV

Neutrino Physics

Course No: **PHY15408DCE**	Max. Marks:	50
	External Examination:	40
No. of credits: **02**	Internal Assessment:	10

UNIT – I

Introduction and Historical Overview, motivation for proposing the neutrino, first discovery by Reines and Cowan and subsequent discoveries, the number of neutrinos, neutrino properties and interactions, neutrino electron elastic scattering, neutrino-nucleon quasi-elastic scattering, neutrino-nucleon deep inelastic scattering, solar neutrinos, atmospheric neutrinos, terrestrial neutrino sources

UNIT – II

Neutrino mass, neutrino oscillations, flavour oscillations in vacuum and matter, solution of the solar and atmospheric problems, limitations of oscillation experiments, direct mass searches, kinematic mass determination, double beta decay, summary of understanding now, outstanding questions and the future of experimental neutrino physics

Text Books:

1. Neutrino Physics by Kai Zubair (CRC Press).
2. Current aspects of neutrino physics. Ed. by David O. Codwell (Springer)

Reference Books:

1. Fundamental of neutrino physics and astrophysics by Carlo Giunti and Chung W. Kim

Semester IV

Density Functional Theory

Course No: **PHY15409GE**	Max. Marks:	100
	External Examination:	80
No. of credits: **04**	Internal Assessment:	20

UNIT – I

Elementary ideas of wave mechanics, Variational principle for the ground state, The Hartree-Fock approximation, Correlation energy, Electron density, Hellmann-Feynman theorem and Virial theorems

Density matrices, Description of quantum states and the Dirac notation, Density Operators, Reduced density matrices for fermion Systems, Spinless density matrices, Hartree-Fock theory in density-matrix form, N-representability of reduced density matrices, statistical mechanics

UNIT – II

Density-Fuctional theory, Thomas-Fermi model, Hohenberg-Kohn theorems, ν and N-representability of an electron density, Levy constrained-search formulation, Finite temperature canonical-ensemble theory, Finite temperature grand-canonical-ensemble theory, finite temperature ensemble theory of classical systems

Thomas Fermi and related models, Traditional TF and TFD models, Theorems in Thomas Fermi Theory, Assessment and modification, Alternative derivation and a Guassian model, Local model, Conventional gradient correction, Thomas-Fermi-Dirac-Weizsacker model, Various related considerations

UNIT – III

The Kohn-Sham method: Basic principles, Introduction of orbitals and the Kohn-Sham equations, Derivation of Kohn-Sham equations, More on the kinetic-energy functional, Local density and Xα approximations, Integral formulation, Extension to nonintegral occupation numbers and transition-state concept

Spin-density functional theory, Spin-density functionals and the local spin-density approximations, Self-interaction correction, The Hartree-Fock-Kohn-energy functional via the exchange-correlation, Exchange-correlation-energy functional via wave-vector analysis, Other studies of the exchange-correlation-energy functional

UNIT – IV

Finite-temperature Kohn-Sham theory, Excited states, Time-dependent systems,

Dynamic linear response, Density-matrix-functional theory, Nonelectronic and multicomponent systems

Remarks on problems of chemical binding, Interatomic forces, Atoms in molecules, More on HSAB principle, Modelling the chemical bond, Bond-charge model, Semiempirical density-functional theory

Text Book:

1. Density-Functional Theory of Atoms and Molecules, by Robert G. Parr , Yang Weitao ". Oxford Science Publications, (1994)

Reference Book:

1. A primer in Density Functional Theory by C. Fiolhais , F. Nogueira , M. Marques, Springer Verlag, Berlin (2003)
2. Density-Functional Theory by R. M. Dreizler and E. K. U. Gross, Springer Verlag, Berlin (1990)

Semester IV

Atmospheric Physics

Course No: **PHY15410GE**	Max. Marks:	100
	External Examination:	80
No. of credits: **04**	Internal Assessment:	20

UNIT – I

Origin, Composition and Mean Structure of the Atmosphere, Vertical profiles of pressure and density, Variable constituents, The vertical temperature structure, General Circulation of the Atmosphere, Energy Balance of the Earth, Global Patterns of Insolation , Heating Imbalances, Earth's Energy Budget, Surface Energy Budget
Modeling Energy Balance, Global Heat Balance, Atmosphere's Energy Budget, Natural Greenhouse Effect, Effect on Surface Temperature

UNIT – II

Gas law and its application to dry air, water vapour, and moist air, Virtual Temperature, Hydrostatic Equation ,Geopotential, Scale Height, hypsometric equation, Reduction of Pressure to Sea Level, specific heat, adiabatic and isothermal processes, concept of air parcel, dry adiabatic lapse rate, potential temperature, first law thermodynamic applied to atmosphere, Moisture Parameters, potential temperature, Claussius Clapeyron equation, latent Heats, Saturated Adiabatic and Pseudoadiabatic Processes, The Saturated Adiabatic Lapse Rate, Equivalent Potential Temperature and Wet-Bulb Potential Temperature, Stability and instability

UNIT – III

Earth coordinate system (latitude, longitude, depth),Dynamic and thermodynamic variables (u,v,w,T,P,density).Forces felt by an air parcel, mathematical development of apparent forces, momentum equations,scale analysis momentum equations, the Rossby Number and geostrophic, Cyclostrophic and gradient Balance, Continuity equation, Energy equation ,Governing equations for synoptic scale.The Thermal Wind, Vertical motion, pressure coordinates,Basic equations in pressure coordinates.

UNIT – IV

Weather and climate, weather forecasting, Numerical weather prediction

models, Global climate models, Working principle, application and circuit descriptions in blocks of the system: Ionosonde, Rdiosonde, Ozonesonde, LIDARS, DIAL, SODARS, AWS, weather Satellites, Doppler Radar, ST Radar and MST radar

Text Books:

1. McIlveen, R., Fundamentals of Weather and Climate, Chapman-Hall, 1992
2. An Introduction to Dynamic Meteorology (3rd edition), J.R. Holton
3. Atmospheric Science: An Introductory Survey by J.M. Wallace and P.V. Hobbs, Academic,
4. 1977, Hargrave Library 551.5 W191A.

Reference Books

1. The Physics of Atmospheres by J.T. Houghton, 1986,
2. Theory of Satellite Orbit in the Atmosphere by King Hele
3. Numerical Analysis by Shastri
4. Weather Satellite by L.F. Hubert
5. Meteorological Satellite by W.K. Widger
6. A guide to Earth Satellite by D. Fishlock

Semester IV

Bose-Einstein Condensates

Course No: **PHY15411GE**	Max. Marks:	50
	External Examination:	40
No. of credits: **02**	Internal Assessment:	10

UNIT – I

The Bose distribution , Density of states ,Transition temperature and condensate fraction , Condensate fraction, Density profile and velocity distribution , Condensed phase , Normal phase , Specific heat close to Tc , Effect of finite particle number.

Magnetic traps , Optical traps , Laser cooling: the Doppler process , The magneto-optical trap, Sisyphus cooling , Evaporative cooling .

UNIT – II

Effective interactions and the scattering length , Scattering length for a model potential , Scattering between different internal states , Inelastic processes , Elastic scattering and Feshbach resonances, Determination of scattering lengths.

The Gross–Pitaevskii equation , The ground state for trapped bosons , A variational calculation , The Thomas–Fermi approximation , Surface structure of clouds , Healing of the condensate wave function, Condensates with dipolar interactions , Dynamics of the condensate in Anisotropic traps , Solitons .

Text Books:

1. Bose-Einestein Condensation in Dilute Gases by C. J. Pethick and H. Smith (Cambridge University Press)

Reference Books:

1. Bose-Einestein Condensation by L. Pitaevskii and S. Stringari (Oxford University Press, 2003)
2. Laser Coupling and Trapping (Graduate Texts in Contemporary Physics) by Harold J. Metcalf, Peter van der Straten (springer 2001)

Semester IV

Modern Communication Systems

Course No: **PHY15412OE**	Max. Marks:	50
	External Examination:	40
No. of credits: **02**	Internal Assessment:	10

UNIT – I

Introduction to wireless communications, example of wireless communication system, the Cellular concept and system design fundamentals, frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, trunk and grade services, Methods for improving coverage and capacity in cellular system,
Multiple access techniques for wireless communications FDMA, TDMA, Spread spectrum techniques, SDMA, Packet Radio, CSMA, Capacity of cellular CDMA with multiple cells and capacity of SDMA

UNIT – II

Wireless systems and standards, AMPS, IS-94, GSM traffic, Examples of GSM cell, frame structure of GSM cello, details of forward and reverse CDMA channels
Personal access communication systems, Personal Mobile satellite communication, Integrating GEO, LEO, MEO Satellite and terrestrial mobile systems, Rake receiver and Advanced Rake receiver

Reference Book:

1. Wireless Communication Principles and Practice: 2nd Edition, Theodore S. Reppaport.
2. Wireless Digital Communication, Dr. Kamilo Feher

Text Books:

1. Electronic Communication System, Wayne Tomasi

Semester IV

Astronomical Techniques

Course No: **PHY15413OE**	Max. Marks:	50
	External Examination:	40
No. of credits: **02**	Internal Assessment:	10

UNIT – I

Telescopes; Types of telescopes. Design and construction of a simple Optical telescopes. Schmidt telescopes. Sky charts and their importance. Solar telescopes. Detectors for optical and infrared regions. Application of CCD's to stellar imaging.

UNIT – II

Astronomical photometry; Simple design of an astronomical photometer. Observing technique with a photometer Correction for atmospheric extinction. Tansformation to a standard photometric system. Astronomical spectroscopy; Spectral classification. Simple design of astronomical spectrograph. Radial velocity measurements.

Text Books:

1. C.R.Kitchin: Astrophysical Techniques
2. Henden and Kaitchuck: Astronomical Photometry.

Reference Books:

1. Gordon Walker: Astronomical Observations - an Optical Perspective (Cambridge University press).
2. Astrophysics-Stars and galaxies by K.D.Abhyankar.
3. C.R.Miczaika and W.M.Sinton: Tools of the Astronomers
4. W.A.Hiltner (Ed): Astronomical Techniques.
5. Carleton: Methods of Experimental Physics. Vol.XIIA.

Semester IV

PROJECT TOUR

Description

The students after completing the 4th Semester Examination shall be taken for an educational tour for 21 days outside the valley to various research institutes around the country to substantiate their knowledge gained during the M. Sc. Course and to provide them an opportunity to explore further avenues in Physics Research.