POST GRADUATE DEPARTMENT OF PHYSICS
UNIVERSITY OF KASHMIR, SRINAGAR

Choice Based Credit System

Course Curriculum (Syllabus for Examination)

For the Academic Year
2017

First Semester

Summary of all the courses

(2017 Batch)

Semester – I				
Course Type	**Course Code**	**Title of the Course**	**No. of Credits**	**Teacher**
Core (CR)	PHY17101CR	Mathematical Physics – I	04	
	PHY17102CR	Quantum Mechanics – I	04	
	PHY17103CR	Lab. Course	04	
Discipline Centric Electives (DCE)	PHY17104DCE	Classical Mechanics	04	
	PHY17105DCE	Electronics	04	
Generic Electives (GE)	PHY17106GE	Environmental Physics	02	
	PHY17107GE	Introduction to Astronomy	02	
	PHY17108GE	Physics for everyone	02	
Open Electives (OE)	PHY17109OE	Biophysics	02	

Note: Syllabi for the following subjects shall be available later on

PHY17106GE	Environmental Physics
PHY17108GE	Physics for everyone

Semester I

Mathematical Physics - I

Course No:	**PHY17101CR**	Max. Marks:	100
		External Examination:	80
No. of credits: **04**		Internal Assessment:	20

UNIT – I

Complex functions, Analytic functions, Cauchy - Riemann conditions, Cauchy's Integral Theorem, Multiply connected regions, Singularities, Cauchy's Integral formula, Derivatives, Taylor and Laurent expansion, Analytic continuation, Poles and Branch Points, Calculus of Residues, Residue theorem, Cauchy principal value, Evaluation of Definite Integral using Cauchy's residues.

UNIT – II

The Gamma Function: Definitions, Simple Properties, Factorial and Double factorial, Digamma and Polygamma Functions, Stirling's Series; The Beta Function, Legendre duplication formula.

Partial Differential Equations, Classes and Characteristics, Boundary Conditions, First-order, Separable variables, Solution of linear first-order ODEs; Seperation of variables in cartesian, Spherical Polar and Cylindrical Coordinates.

UNIT – III

Singular points, Solution of Second order Differential Equations using Frobenius Method, Limitations of series approach; Second solution, Linear independence of solutions.

Orthogonal Functions, Self-Adjoint ODEs, Hermitian Operators, Gram–Schmidt Orthogonalization, Orthogonal Polynomials, Completeness of Eigenfunctions.

UNIT – IV

Bessel Functions of First kind, Orthogonality, Neuman Functions, Henkel Functions,

Modified Bessel Functions, Spherical Bessel Function; Legendre Function, Orthogonality, Associated Legendre Function, Spherical Harmonics, Hermite Functions; Laguerre Functions.

Text Book:

1. Mathematical Methods for Physicists (6th Ed.), G. B. Arfken and H. J. Weber, Academic Press

Reference Books:

1. Mathematical Methods For Students of Physics and Related Fields, Sadri Hassani, Springer (2009)
2. Mathematical Physics: A Modern Introduction to Its Foundations, Sadri Hassani, Springer (2002)
3. Advanced Engineering Mathematics by Michel D, Greenberg
4. Mathematical Methods for Physics and Engineering (3rd Ed.), Riley, Hobson and Bence, Cambridge
5. Advanced Engineering Mathematics, E Kreyzig (8th Ed.), Wiley
6. Complex Analysis by E. C. Tichmersh
7. Differential Equations by H. J. H. Piagin

Semester I

Quantum Mechanics - I

Course No:	**PHY17102CR**	Max. Marks:	100
		External Examination:	80
No. of credits: **04**		Internal Assessment:	20

UNIT – I

Principle of superposition and uncertainty principle, Operators, Addition and multiplication of operators, Continuous spectrum, Passage to the limiting case of classical mechanics, Wave function and the measurement

Hamiltonian operator, Differentiation of operator with time, Stationary States, Transformation of matrices, Heisenberg representation of operators, Density matrix, Momentum representation and uncertainty relations

UNIT – II

Schrodinger's equation, Fundamental properties, Current density, General Properties of motion in one dimension, Potential well, Linear oscillator, Motion in a homogeneous field, Transmission coefficient and applications

Angular momentum, Eigenvalues and eigenfunctions of angular momentum, Matrix elements of vectors, Parity of a state.

UNIT – III

Addition of angular momentum, Clebsch-Gordon Coefficients, Symmetry Relations of CG coefficients, Evaluation of CG coefficients.
Matrix representation of the rotation operators, CG series, Determination of the rotation matrices, orthogonality and normalization of the rotation matrices.

UNIT – IV

Motion in a centrally symmetric field, Spherical waves, Three dimensional oscillator, Resolution of a plane wave
Fall of a particle to the Centre, Motion in a coulomb field (spherical polar coordinates), Discrete and continuous spectrum, Coulomb problem in parabolic coordinate system

Text Books:

1. L. D. Landau and E. M. Lifshitz , Quantum Mechanics, Pergamon Press
2. M.E. Rose. Elementary theory of Angular Momentum.

Reference Books:

1. R. Liboff: Quantum mechanics
2. R.S. Shankar: Quantum mechanics
3. David Bohm: Quantum Mechanics.

Semester I

Lab. Course

Course No:	**PHY17103CR**	Max. Marks:	100
		External Examination:	50
No. of credits: **04**		Internal Assessment:	50

Description

There shall be about 20 experiments available in the lab out of which the student shall have to complete at least 06 experiments in this semester.
The list of experiments presently available is as follows:

- To determine the wave length of a laser with a diffraction grating.
- To determine the energy gap of a semiconductor using Four probe method.
- To determine the curie temperature of an electrical material BaTio3
- To determine the dead time and absorption Co-efficient using G.M. Counter.
- ESR: Electron Spin Resonance.
- To determine the velocity of ultrasound in a given liquid medium (kerosene)
- To determine the Hall coefficient for a semiconductor sample.
- Designing and studying RC filters Active and Passive.
- To Determination of e/m ratio of electron by J.J. Thomson's method.
- To Determination of e/m ratio of electron by Helical method
- To determine the velocity of sound using Lissajous figures.
- Determination of Plank's constant using Photoelectric Effect.
- Antenna measurements
- Michelson Interferometer
- Fabry-Perot Interferometer
- Study of Regulated Power Supply
- Study sinusoidal steady-state response of a resonant circuit in the phasor domain.
- To determine the characteristics of a Solar Cell.
- Study Digital Fiber Optical Transmitter and Receiver.
- Fast Fourier Transform (FFT) in Excel

Semester I

Classical Mechanics

Course No: **PHY17104DCE** Max. Marks: 100

External Examination: 80

No. of credits: **04** Internal Assessment: 20

UNIT – I

The Lagrangian Approach to Mechanics: degrees of freedom, constraints and generalized coordinates, virtual displacement, virtual work and generalized force, d'Alembert's principle and the generalized equation of motion, the Lagrangian and the Euler Lagrange equation of motion, the Hamiltonian, cyclic coordinates and canonical momenta, applications; double pendulum, spherical pendulum, particle in electromagnetic field.

UNIT – II

Variational calculus and Hamiltonian dynamics: the variational calculus and the Euler equation, the principle of least action and the Euler Lagrange equation, constraints in variational dynamics.

Hamiltonian dynamics: Legendre transformations, Hamilton's equations, conservation laws, phase space and Liouville's theorem.

UNIT – III

Theoretical Mechanics: canonical transformations and generating functions, symplectic notation, Poisson Brackets (PB); the angular momentum PB relations, invariance of PBs under canonical transformations, action-angle variables and adiabatic invariance, the Hamilton Jacobi (HJ) Equation; HJ equation for Hamilton's characteristic function, separation of variables, particle motion under central force.

UNIT – IV

Oscillations: the simple harmonic oscillator; the damped harmonic oscillator, the damped simple and damped harmonic oscillator, coupled simple harmonic oscillators;

couple pendulum, general method of solution.
Lagrangian and Hamiltonian of continuous systems: transition from discrete to continuous systems, the Hamiltonian formulation, Noether's theorem

Text Books:

1. Classical Mechanics by Goldstein, Poole and Safko (Pearson Education).
2. Mechanics by Landau and Lifshitz

Reference Books:

1. Analytical Mechanics by L. N. Hand and J. D. Finch (Cambridge University Press)

Semester I

Electronics

Course No:	**PHY17105DCE**	Max. Marks:	100
		External Examination:	80
No. of credits: **04**		Internal Assessment:	20

UNIT – I

Classification of solids based on energy band theory, Mobility and conductivity, Intrinsic Semiconductors Electrons and Holes in the semiconductors. Extrinsic semiconductors – Donor and Acceptor impurities, The work function, Band diagram of junctions, Metal-semiconductor junctions, Ohmic contact, Schottky contact, Semiconductor-semiconductor junction,

PN junction – Open circuited, PN junction Diode – Reverse and Forward bias, VI characteristics, Current components in PN diode-Diode current, Reverse saturation current, Majority carrier current components, Current Equations – Diffusion and Drift current, Switching Characteristics of PN Diode.

UNIT – II

Junction field effect transistor (JFET), MOSFETs : Depletion MOSFET, Enhancement MOSFET; Biasing of MOSFETs. Small signal parameters. Common Drain, Common source and common gate. Differential amplifiers: Inverting and non-inverting inputs. Various modes of operation.

Operational amplifiers (Op amps): Op amp characteristics and specifications. Inverting and non-inverting amplifiers and their analysis; Summing, Scaling and Average amplifiers. Integrators and differentiators. Log amplifier etc. Active filters.

UNIT – III

Metal-Semiconductor Junction- MESFET, Schottky barrier diode - Zener diode - Varactor diode Tunnel diode- UJT, SCR, LED, LCD, Photo transistor, Opto Coupler, LASER diode, LDR, Solar cell, CCD. Transducers , Transducer Classification, Transducer Applications.

UNIT – IV

Number systems and their inter-conversion; Boolean algebra; Logic gates; De-Morgan's theorem; Logic Families: TTL, MOS and CMOS; Combinational Circuits: Adders, subtractors, Encoder, De-coder, Comparator, Multiplexer, De-multiplexers, Parity

generator and checker; Sequential Circuits: Flip-flops, Registers, Counters, Memories; A/D and D/A conversion. INTEL 8085 microprocessor: Architecture and programming; I/O interfacing using PPI 8255 and 8155; Architectural evolution in 16-bit, 32-bit and 64-bit microprocessors.

TEXT BOOKS

1. Donald A Neaman, "Semiconductor Physics and Devices", Third Edition, Tata Mc Graw Hill Inc., 2007.

REFERENCES

2. Yang, "Fundamentals of Semiconductor devices", McGraw Hill International Edition, 1978.
3. Robert Boylestad and Louis Nashelsky, "Electron Devices and Circuit Theory" Pearson Prentice Hall,
10th edition,July 2008.
4. R.S.Sedha., "A Text Book of Applied Electronics", S.Chand Publications, 2002.
5. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, "Electronic Devices and circuits", First Edition, Tata
McGraw- Hill, 1999.
6. "Solid State Electronic Devices", B.G. Streetman & S. K. Banerjee, Prentice Hall International Editions,
6th
7. "Microelectronics circuits" by Sedra & Smith.
8. S.M. Sze & Kwok K. Ng, Physics of Semiconductor Devices, Wiley 2007
9. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085, Penram
India (1999).

Semester I

Introduction to Astronomy

Course No:	**PHY17107GE**	Max. Marks:	50
		External Examination:	40
No. of credits: **02**		Internal Assessment:	10

UNIT – I

Celestial Sphere and Time; Constellations and nomenclature of stars. The cardinal points and circles on the celestial sphere. Equatorial, ecliptic and galactic system of co-ordinates. Spherical triangle and related problems. Aspects of sky from different places on the earth. Twilight, Seasons, Sidereal. Apparent and Mean solar time and their relations. Equation of time. Ephemeris and Atomic Times. Calendar. Julian date and heliocentric correction.

UNIT – II

Stellar Distances and Magnitudes; Distances of stars from the trigonometric, statistical and moving cluster parallax. Stellar motions. Magnitude scale and magnitude systems. Atmospheric extinction. Absolute magnitudes and distance modulus. Stellar Classification, H-R Diagram, Black-body approximation to the continuous radiation and temperatures of stars. Variable stars as distance indicators.

Text Books.

1. W.M.Smart: Text book of Spherical Astronomy
2. K.D.Abhyankar: Astrophysics: Stars and Galaxies.Tata McGraw Hill Publication

Reference Books:

1. A.E.Roy: Orbital Motion.
2. McCusky: Introduction to Celestial Mechanics
3. G.Abell: Exploration of the Universe.
4. A. Unsold: New Cosmos. Baidyanath Basu: Introduction to Astrophysics.
5. Baidyanath Basic: Introduction to Physics

Semester I

Biophysics

Course No:	**PHY17109OE**	Max. Marks:	50
		External Examination:	40
No. of credits: **02**		Internal Assessment:	10

UNIT – I

Radiological Physics

Properties of Electromagnetic Radiation, Radiation Units, Exposure and Dose, Dose equivalent Unit, Particle flux, X Rays and Gamma Rays, their interaction with matter, Photoelectric and Compton effect, Ion pair production, Principles of Radiation detection and measurements, General requirement of dosimeters, Telegamma Unit (Cobalt Unit), Radio Isotopes in Biology, Agriculture plant breeding, soil plant relationship and plant physiology, Medicine and diagnosis.

UNIT – II

Radiation Safety measures

Natural and manmade Radiation exposure or principle of Dose Equivalent limit (DEL), Maximum permissible Dose (MPD), Evaluation of External and internal Radiation hazards, Radiation protection measures in Industrial establishment, Radio Isotope labs, Diagnostics and therapeutic installations during transportation of Radioactive substances, Disposal of Radioactive waste, Administrative and Legislative aspect of Radiation protection

Text Books:

1. Casarett A.P. (1968), Radiation Biology, Prentice-hall Inc.
2. Clause W.D. (1958), Radiation Biology and Medicine, Addison- Wesley.
3. Grosch D.S. (1979), Biological effects of Radiation, Academic Press.
4. Howard L. A. (1974), Radiation Biophysics, Prentice Hall Inc.

References Books:

1. Knoll G.E.(1979), Radiation detection and measurement, John Wiley and sons.