Course Curriculum & Syllabus

Under Choice Based Credit System (CBCS)

[Effective for 2020-21 admitted batch Only]

M.Sc. Physics

I Semester

Department of Physics

College of Science & Technology

Andhra University, Visakhapatnam

January 2021

ANDHRA UNIVERSITY
VISAKHAPATNAM

DEPARTMENT OF PHYSICS

Course Structure for M.Sc. Physics

(Effective for 2020-2021 Academic Year Admitted Batch Students only)

I Semester

Paper Code	Title of the Paper	T	P	Semester end Exam Marks	Mid Sem. Marks	Total Marks	Credits
P-101	Classical Mechanics	4		80	20	100	5
P-102	Introductory Quantum Mechanics	4		80	20	100	5
P-103	Mathematical Methods of Physics	4		80	20	100	5
P-104	Electronic Devices & Circuits	4		80	20	100	5
P-105	Modern Physics Lab (Practical-80 & Record-20)		6	100		100	4
P-106	Electronics Lab (Practical-80 & Record-20)		6	100		100	4
	Total	16	12	520	80	600	28

(T: Theory hours, P: Practical hours)

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DEPARTMENT OF PHYSICS
Syllabus
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M.Sc. Physics

I SEMESTER

P101 : CLASSICAL MECHANICS

UNIT-I: Mechanics of a particle. Mechanics of a system of particles, constraints, D'Alembert's principle and Lagrange's equations, Velocity Dependent potentials and the Dissipation function Simple applications of the Lagrangian Formulation
Chapter: 1. Section: 1, 2, 3, 4, 5 & 6.
Hamilton's principle, some techniques of the calculus of variations. Derivation of Lagrange's equations from Hamilton's principle. Conservation theorems and symmetry properties, Energy function and the conservation of Energy
Chapter: 2. Section: 1, 2, 3, 5 & 6

UNIT-II: Reduction to the equivalent one body problem. The equation of motion and first Integrals, The equivalent One – Dimensional problem and classification of orbits, The differential equation for the orbit, and Integrable power –law potentials, Conditions for closed orbits (Bertrand's theorem), The Kepler problem inverse square law of force , The motion in time in the Kepler problem, Scattering in a central force field..
Chapter: 3. Section. 1, 2, 3, 5, 6, 7 & 8
Legendre transformations and Hamilton's equations of motion. Cyclic Coordinates, Derivation of Hamilton's equation of motion from variational principle, Principle of Least Action.
Chapter: 7 Section: 1, 2, 3, 4 & 5.

UNIT-III: Equations of canonical transformation, Examples of Canonical transformations, The harmonic Oscillator, Poisson brackets and other Canonical invariants, Equations of motion, Infinitesimal canonical transformations, and conservation theorems in the poisson bracket formulation, the angular momentum poisson bracket relations.
Chapter: 8. Section: 1, 2, 4, 5, 6 & 7.
Hamilton – Jacobi equation of Hamilton's principal function, The Harmonic oscillator problem as an example of the Hamilton – Jacobi Method, Hamilton – Jacobi equation for Hamilton's characteristic function. Action – angle variables in systems of one degree of freedom.
Chapter: 9. Section: 1, 2, 3 & 5.

Text Book:
Classical Mechanics - H. Goldstein

Reference Books:
Classical Mechanics - J. B. Upadhayaya
Classical Mechanics - Gupta, Kumar and Sharma

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I SEMESTER

P102 : INTRODUCTORY QUANTUM MECHANICS

UNIT-I: Failures of classical physics, Origin of Quantum theory, the Conceptual aspect: Modifications needed to the classical concepts of particles and Waves (Wave Particle Duality), Interpretations of Quantum mechanics, Applications of uncertainty principle, Principle of superposition - Wave packets, Schrodinger Wave Equation, wave function interpretation, Problems and admissibility conditions, probability current density, expectation value, Ehrenfest theorem, stationary states.

UNIT-II: Bracket notation, orthonormal functions, linear operators and their properties, Hermitian operator, Schmidt orthogonalization, Postulates of quantum mechanics, simultaneous measurability of observables, commutator algebra, equation of motion of an operator (Schrodinger representation), Momentum representation - Dirac delta function and properties.

UNIT-III: One dimensional problems - Particle in a potential well with (i) infinite walls, (ii) finite walls. Potential step, Potential Barrier. Linear Harmonic Oscillator (Schrodinger method). Free particle. Particle moving in a spherically symmetric potential, spherical harmonics, radial equation. Eigen values and Eigen functions of rigid rotator, hydrogen atom, Hydrogenic orbitals, angular momentum operators, commutation relations, Eigen values and Eigen functions of L^2 , L_Z, L_+ and L_- operators, spin angular momentum, general angular momentum.

Text Book:
Quantum Mechanics R. D. Ratna Raju

Reference Books:

1) Quantum Mechanics - Aruldhas
2) Quantum Mechanics - G. S. Chaddha
3) Quantum Mechanics - B. H. Bransden and C. J. Joachain
4) Quantum Mechanics - E. Merzbacher
5) Quantum Mechanics - Richard Liboff
6) Quantum Mechanics - Gupta, Kumar and Sharma
7) Quantum Chemistry - Ira N. Levine
8) Quantum Mechanics - Nouredine Zettili

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I SEMESTER

P103 : MATHEMATICAL METHODS OF PHYSICS

Unit I: Complex Variables

Function of complex number- definition-properties, analytic function-Cauchy –Riemann conditions-polar form-problems, Complex differentiation, complex integration –Cauchy's integral theorem- Cauchy's integral formulae-multiply connected region- problems, Infinite series-Taylor's theorem- Laurrent's theorem-Problems, Cauchy's Residue theorem- evaluation of definite integrals-problems.

Unit II: Beta, Gamma functions &Special functions

Beta & Gamma functions -definition, relation between them- properties-evaluation of some integrals

Special Functions- Legendre Polynomial, Hermite Polynomial, Laguerre Polynomial-Generating function-recurrence relations - Rodrigue's formula-orthonormal property-associated Legendre polynomial- simple recurrence relation-orthonormal property-spherical harmonics

Unit III: Laplace Transforms & Fourier series, Fourier Transforms

Laplace Transforms – definition- properties – Laplace transform of elementary functions-Inverse Laplace transforms-properties- evaluation of Inverse Laplace Transforms-elementary function method-Partial fraction method-Heavyside expansion method-Convolution method-complex inversion formula method-application to differential equations Fourier series-evaluation of Fourier coefficients- Fourier integral theorem-problems-square wave-rectangular wave-triangular wave.

Fourier Transforms- infinite Fourier Transforms-Finite Fourier Transforms-Properties-problems-application to Boundary value problem

Text Books:

1. Mathematical Methods of Physics - G. Arfken,
2. Mathematical Physics - Satya Prakash
3. Complex Variables - Murray R Spiegel (Schaum's outline series)
4. Mathematical Physics - B.S. Rajput
5. Laplace and Fourier Transforms Goyal and Gupta

Reference Books:

1) Mathematical Methods - B. D. Gupta
2) Special Functions - M. D. Raisinghania
3) Integral Transforms - M. D. Raisinghanna
4) Integral Transforms - Goyal and Gupta

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I SEMESTER

P104 : ELECTRONIC DEVICES AND CIRCUITS

UNIT-I

SEMICONDUCTOR DEVICES:

Tunnel diode, photo diode, solar cell, LED, Silicon controlled Rectifier, Uni Junction Transistor, Field Effect Transistor, (JFET & MOSFET), CMOS

UNIT-II

MICROWAVE DEVICES:

Varactor diode, Parametric Amplifier, Thyristors, Klystron, Reflex Klystron, Gunn Diode, Magnetron, CFA, TWT, BWO, IMPATT, TRAPATT, APD, PIN Diode, Schottky Barrier Diode.

UNIT-III

OPERATIONAL AMPLIFIERS:

The ideal Op Amp – Practical inverting and Non inverting Op Amp stages. Op Amp Architecture – differential stage, gain stage, DC level shifting, output stage, offset voltages and currents. Operational Amplifier parameters- input offset voltage, input bias current, Common Mode Rejection Ratio, Slew Rate, Summing amplifier, Integrator, Differentiator, Voltage to Current converter, Current to Voltage converter, IC 723 Voltage regulator

Text Books:

1. Integrated Electronics - Jacob Millman & C.C. Halkies
2. Op.Amps and Linear Integrated Circuits - Ramakant A.Gayakwad
3. Electronic Communication Systems - George Kennedy

Reference Books:

1. Microelectronics - Jacob Millman & Arvin Grabel
2. Electronic Devices and Circuits - G.K. Mithal
3. Op-amps and Linear Integrated Circuits - D. Mahesh Kumar

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I SEMESTER

P105 : MODERN PHYSICS LAB

LIST OF EXPERIMENTS

1. Atomic Spectrum of Sodium
2. Atomic Spectrum of Zinc
3. Rydberg Constant using Grating
4. Raman Spectrum of Carbon Tetrachloride (CCl_4)
5. Specific Charge of an Electron using Thomson's Method
6. Determination of Planck's Constant

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I SEMESTER

P106 : ELECTRONICS LAB

LIST OF EXPERIMENTS

1. FET Amplifier (BFW 10/11)
2. Negative Feedback Amplifier (BC 147)
3. Colpitt's Oscillator (BF 194)
4. Phase Shift Oscillator (BC 147)
5. Astable Multivibrator (BF 194)
6. Op. Amp. Characteristics (IC 741)