

DEPARTMENT OF PHYSICS
ANDHRA UNIVERSITY

Common for M.Sc. Physics and M.Sc. Space Physics
I Semester
(w.e.f 2009-10 batch)

P101,SP101: 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

5 Hrs.

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

6 Hrs.

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

7 Hrs

Legendre transformations and Hamilton's equations of motion. Cyclic Coordinates and conservation theorems, Derivation of Hamilton's equation of motion from variational principle, Principle of Least Action.

6 Hrs

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.

5Hrs

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.

8 Hrs.

Chapter : 9. Section : 1, 2, 3, & 5.

UNIT-IV: Independent coordinates of rigid body. , The Euler angles, Euler's theorem on the Motion of a rigid body, Infinitesimal rotations, Rate of change of a vector, The Coriolis Effect.

Chapter : 4. Section : 1, 4, 6, 8, 9 .

The Inertia tensor and the moment of inertia, The Eigenvalues of the inertia tensor and the principal axis transformation, Solving rigid body problems and Euler equations of motion, Torque – free motion of a rigid body

6 Hrs

Chapter 5 Section: 3, 4, 5 & 6.

The Eigenvalue equation and the principal axis transformation, Frequencies of free vibration, and normal coordinates, Free vibrations of a linear triatomic molecule

Chapter 10 Section: 2, 3 & 4 .

6

Hrs

TEXT BOOKS : Classical Mechanics H.Goldstein (Addison-Wiley, 1st & 2nd ed)

REFERENCE BOOK: Classical Dynamics of Particles and Systems J.B.Marion.

DEPARTMENT OF PHYSICS
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Common for M.Sc. Physics and M.Sc. Space Physics
I Semester
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P102,SP102 : INTRODUCTORY QUANTUM MECHANICS

UNIT-I: The Conceptual aspect :Wave particle duality,Bohr's complementarity principle.Wave function and its interpretation -Principle of superposition-Wave packets – phase velocity and group velocity-Uncertainty relation Postulates of Quantum Mechanics - Schrodinger wave equation - Conservation of probability

UNIT-II: Operators and their properties - Equation of Motion for operators, Hermitian operators and their Eigen values and eigen functions Stationary states, Bohr's correspondence principle - Coordinate and Momentum representation- Ehrenfest's theorem Commutator Algebra.- Dirac Delta function, definition and properties. Dirac Delta Normalization

UNIT-III: One dimensional problems - Free Particle, Particle in a box- Potential step, potential Well, Rectangular Potential Barrier - Linear Harmonic Oscillator Angular Momentum, Angular Momentum in spherical polar coordinates, Eigenvalues and eigenfunctions of L^2 , L_z , L_+ and L_- operators. Eigen values and eigen functions of Rigid rotator and Hydrogen atom. Commutation relations, electron spin.

UNIT-IV: Time- independent perturbation theory for(i) non degenerate systems and application to Hydrogen atom: Kinetic energy correction, spin-orbit interaction, fine structure. Ground state of Helium atom.

ii) degenerate systems, application to linear stark effect in Hydrogen.
Variation method and its application to Helium atom.
Exchange energy and low lying excited states of Helium atom.
Interaction of electromagnetic radiation with matter. Selection rules.

Text Book :

Quantum Mechanics R.D. RATNA RAJU

Reference Books :

1. Quantum Mechanics Aruldas
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

DEPARTMENT OF PHYSICS
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Common for M.Sc. Physics and M.Sc. Space Physics
I Semester
(w.e.f 2009-10 batch)
P103,SP103: Mathematical Methods of Physics

Unit I : Complex Variables

15 Hrs

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-Laurent’s theorem-Problems, Cauchy’s Residue theorem- evaluation of definite integrals-problems.

Text Book: 1. Mathematical Methods of Physics-G.Arffen, Academic Press

2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi

3. Complex Variables (Schaum’s out line series) Murray R. Spiegel

Ref Book: Mathematical Methods B.D.Gupta

Unit II : Beta , Gamma functions & Special functions

10 Hrs

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

Text Book: 1. Mathematical Methods of Physics-G.Arffen, Academic Press

2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi

3. Mathematical Physics B S Rajput

Ref book : Special Functions .M.D.Raisinghania

Unit III : Laplace Transforms & Fourier series, Fourier Transforms

15 Hrs

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 Book: 1. Mathematical Methods of Physics-G.Arffen, Academic Press

2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi

3. Laplace n Fourier Transforms Goyal & Gupta,

Ref books: Integral Transforms M.D.Raisinghanna

Integral Transforms Goyal & Gupta

Mathematical Physics B S Rajput

Unit IV: Numerical Analysis

10 Hrs

Solutions of algebraic and Transcendental equations-Bisection method-method of successive approximations-method of false position Iteration method-Newton Rapson method

Simultaneous linear algebraic equations-Gauss elimination method-Gauss Jordan method-Matrix inversion method-jacobi method – Gauss-Siedel method

Interpolation with equal intervals-Finite differences-Newton Forward & Backward

Interpolation formule Interpolation with unequal internals-Newtons divided difference

formula-Lagrange interpolation formula Numerical Integration-General Quadrature formula-Trapezoidal rule -Simpson’ 1/3 rule & 3/8 rule

Text Books: **Introductory methods of Numerical analysis S.S.Sastry**

Numerical Methods V.N.Vedamurthy & N.Ch.S.N.Iyengar

DEPARTMENT OF PHYSICS
ANDHRA UNIVERSITY
Common for M.Sc. Physics and M.Sc. Space Physics
I Semester
(w.e.f 2009-2010 admitted batch of students)
P104,SP104: ELECTRONIC DEVICES AND CIRCUITS

UNIT-I

SEMICONDUCTOR DEVICES: 10 Hrs.
Tunnel diode, photo diode, solar cell, LED, Silicon controlled Rectifier,
Uni Junction Transistor, Field Effect Transistor, (JFET & MOSFET), CMOS

UNIT-II

MICROWAVE DEVICES: 15 Hrs.
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 : 10 Hrs.
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

UNIT-IV

OP- AMP APPLICATIONS: 15 Hrs.
Summing amplifier, Integrator, Differentiator,
Voltage to Current converter, Current to Voltage converter
Oscillators – Phase shift oscillator, Wien-Bridge Oscillator, Voltage Controlled Oscillator,
Schmitt Trigger
Special applications – Monostable and Astable multivibrators using 555, Phase locked
Loop, Voltage regulators.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Microelectronics - Jacob Millman & Arvin Grabel (McGraw Hill)
2. Electronic Devices and Circuits – G.K. Mithal (Khanna)
3. Op-amps and Linear Integrated Circuits – D. Mahesh Kumar (MacMillan).

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Common for M.Sc. Physics and M.Sc. Space Physics
I Semester
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P105 / SP105 : MODERN PHYSICS LAB - I

1. Atomic Spectrum of Zinc.
 - a) Verification of Lande's interval rule
 - b) Study of relative intensities

2. Grating spectrometer
 - a) Wavelengths of Hg spectrum,
 - b) wavelength of Balmer series, Rydberg constant

3. Reciprocal dispersion curve
4. Application of Point Groups.
 - a) Identification of symmetry operations in H_2O , BH_3 , NH_3 and H_2CO
 - b) Reducible representations and Vibrational modes of H_2O .
5. Determination of Planck's constant, work function and threshold frequency
6. Band gap of a semiconductor. (Two Probe Method)
7. Thermo emf
8. The Franck-Hertz experiment
9. Band spectrum of CN in the violet
 - a) conversion of given wavelengths to wavenumbers and assignment of (ν , ν')
 - b) Deslandres' table and Vibrational constants.

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DEPARTMENT OF PHYSICS
Common for M.Sc. Physics and M.Sc. Space Physics
I Semester
(w.e.f 2009-10 batch)
P106/SP106: ELECTRONICS LAB -I

LIST OF EXPERIMENTS

- | | |
|-------------------------------------|--------------|
| 1. FET amplifier | (BFW 10/11) |
| 2. Negative feedback amplifier | (BC 147) |
| 3. Colpitts Oscillator | (BF 194) |
| 4. Phase shift Oscillator | (BC 147) |
| 5. Astable Multivibrator | (BF 194) |
| 6. Op.Amp.Characteristics | (IC 741) |
| 7. Power Supply | |
| 8. UJT Characteristics | (2 N 2646) |
| 9. R.F.Amplifier | (BF 194) |
| 10. Boot-strap time based generator | (2N 2222) |

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Variation method and its application to Helium atom.

Exchange energy and low lying excited states of Helium atom.

Interaction of electromagnetic radiation with matter. Selection rules.

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P103,SP103: Mathematical Methods of Physics

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15 Hrs

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Unit III : Laplace Transforms & Fourier series, Fourier Transforms

15 Hrs

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

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Unit IV: Numerical Analysis

10 Hrs

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Interpolation with equal intervals-Finite differences-Newton Forward & Backward Interpolation formulæ Interpolation with unequal intervals-Newton’s divided difference formula-Lagrange interpolation formula Numerical Integration-General Quadrature formula-Trapezoidal rule -Simpson’s 1/3 rule & 3/8 rule

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Numerical Methods V.N.Vedamurthy & N.Ch.S.N.Iyengar

P104,SP104: ELECTRONIC DEVICES AND CIRCUITS

UNIT-I: SEMICONDUCTOR DEVICES:

10 Hrs.

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

UNIT-II: MICROWAVE DEVICES:

15 Hrs.

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 :

10 Hrs.

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

UNIT-IV

15 Hrs.

OP- AMP APPLICATIONS:

Summing amplifier, Integrator, Differentiator, Voltage to Current converter, Current to Voltage converter
Oscillators – Phase shift oscillator, Wien-Bridge Oscillator, Voltage Controlled Oscillator, Schmitt Trigger
Special applications – Monostable and Astable multivibrators using 555, Phase locked Loop, Voltage regulators.

TEXT BOOKS:

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P105 / SP105 : MODERN PHYSICS LAB - I

1. Atomic Spectrum of Zinc.
 - a) Verification of Lande's interval rule
 - b) Study of relative intensities
2. Grating spectrometer
 - a) Wavelengths of Hg spectrum,
 - b) wavelength of Balmer series, Rydberg constant
3. Reciprocal dispersion curve
4. Application of Point Groups.
 - a) Identification of symmetry operations in H_2O , BH_3 , NH_3 and H_2CO
 - b) Reducible representations and Vibrational modes of H_2O .
5. Determination of Planck's constant, work function and threshold frequency
6. Band gap of a semiconductor. (Two Probe Method)
7. Thermo emf
8. The Franck-Hertz experiment
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 - a) conversion of given wavelengths to wavenumbers and assignment of (ν' , ν'')
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I Semester (w.e.f 2009-10 batch)

P106/SP106: ELECTRONICS LAB -I

LIST OF EXPERIMENTS

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| 4. Phase shift Oscillator | (BC 147) |
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| 7. Power Supply | |
| 8. UJT Characteristics | (2 N 2646) |
| 9. R.F.Amplifier | (BF 194) |
| 10. Boot-strap time based generator | (2N 2222) |

