ADIKAVI NANNAYA UNIVERSITY
M.Sc. Physics
II Semester
(w.e.f 2016-17 Admitted batch)
P201 : STATISTICAL MECHANICS

UNIT-I : Basic Methods and Results of Statistical Mechanics: **13 Hrs**

Specification of the state of a system, phase space and quantum states,

Liouvilles theorem, Basic postulates, Probability calculations, concept of ensembles, thermal interaction, Mechanical interaction, quasi static process, distribution of energy between systems in equilibrium, statistical calculations of thermo dynamic quantities, Isolated systems(Microcanonical ensemble). Entropy of a perfect gas in microcanonical ensemble. Canonical ensemble - system in contact with heat reservoir, system with specified mean energy, connection with thermodynamics, Energy fluctuations in the canonical ensemble . Grand canonical ensemble, Thermodynamic function for the grand canonical ensemble. Density and energy fluctuations in the grand canonical ensemble. Thermodynamic equivalence of ensembles. Reif Ch:2, 3.3,3.12 Ch:6

UNIT-II : Simple Applications of Statistical Mechanics: **12 Hrs**

Partition functions and their properties. Calculation of thermo dynamic quantities to an ideal mono atomic gas. Gibbs paradox, validity of the classical approximation. Proof of the equipartition theorem. Simple applications – mean K.E. of a molecule in a gas. Brownian motion. Harmonic Oscillator, Specific heats of solids (Einstein and Debye model of solids), Paramagnetism, Partition function for polyatomic molecules, Electronic energy, vibrational energy and rotational energy of a diatomic molecule. Effect of Nuclear spin-ortho and para Hydrogen. Reif Ch:7, Ch:9.12

UNIT-III: Quantum Statistics: **15 Hrs**

Formulation of the statistical problem. Maxwell–Boltzmann statistics. Photon statistics, Bose-Einstein statistics, Fermi–Dirac statistics, Quantum statistics in the classical limit, calculation of dispersion for MB, BE & FD statistics Equation of state of an Ideal Bose Gas, Black body radiation, Bose-Einstein condensation, Equation of state for a weakly degenerate and strongly degenerate ideal Fermi gas. Thermionic emission. The theory of white dwarf stars. Reif Ch:9

UNIT – IV: RELATIVISTIC MECHANICS

Introduction: Postulates of relativistic mechanics. Minkowski Space, Geometrical representation of Lorentz transformation of space and time. Application to Lorentz transformation. Geometrical representation of Simultaneity, length-contraction and time dilation. Space like and time like intervals. Relativistic classification of particle, Basic ideas of general theory of relativity.

(Sathya Praksah)

Text Books

1. Fundamentals of Statistical and Thermal Physics F. Reif
2. Statistical Mechanics, Theory and Applications S.K. Sinha
3. Statistical Mechanics R.K. Pathria
4. Statistical Mechanics,B.K. Agarwal and M. Eisner, New International (P) Ltd., New Delhi, 2007.
5. Relativistic Mechanics, Satya Prakash, Pragathi Prakashan, Meerut,1987.

ADIKAVI NANNAYA UNIVERSITY
II Semester
M.Sc. Physics
(w.e.f 2016-17 Admitted batch)
P202 : ELECTRO DYNAMICS.

UNIT-I: Gauss Theorem, Poission's equation, Laplaces equation, solution to Lapalaces equation in cartesian coordiantes, spherical coordinates, cylidrical coordinates, use of Laplaces equation in the solutions of electrostatic problems. **6Hrs**
Ampere's circuital law, magnetic vector potential, displacement current, Faraday's law of electromagnetic inducation, **4Hrs**

UNIT-II;
Maxwell's equations, differential and integral forms, physical significance of Maxwell's equations. **4 Hrs**

Wave equation, plane electromagnetic waves in free space , in nonconducting isotropic medium, in conducting medium, electromagnetic vector and scalar potentials, uniqueness of electromagnetic potentials and concept of gauge, Lorentz gauge, Coulomb gauge **6Hrs**

Charged particles in electric and magnetic fields: charged particles in uniform electric field, charged particles in homogerous magnetic fields, charged particles in simultaneous electric and magnetic fields, charged particles in nonhomogeneous magnetic fields. **6Hrs**

UNIT-III: Lienard-Wiechert potentials, electromagnetic fields from Lienard-wiechert potentials of a moving charge, electromagnetic fields of a uniformly moving charge, radiation due to non-relativistic charges, radiation damping, Abraham-Lorentz formula, cherenkov radiation, radiation due to an oscillatory electric dipole, radiation due to a small current element. Condition for plasma existence, occurrence of plasma, magneto hydrodynamics, plasma waves 10**Hrs**

UNIT-IV: Transformation of electromagentic potentials, Lorentz condition in covariant form, invariance or covariance of Maxwell field eqations in terms of 4 vectors, electromagnetic field tensor, Lorentz transformation of electric and magnetic fields. **12 Hrs**

Text books:
1. Classical Electrodynamics : - J.D. Jackson
2. Introduction to Electrodynamics : - D.R. Griffiths
3. .Electromagnetic Theory and Electrodynamics - Satyaprakash
4. Electrodynamics - KL Kakani

ADIKAVI NANNAYA UNIVERSITY

M.Sc. Physics

II Semester

(w.e.f 2016-17 Admitted batch)

203 – NUMERICAL TECHNIQUES & COMPUTER PROGRAMMING

UNIT- I: NUMERICAL TECHNIQUES

Solution of algebraic and transcendental equations: Bisection method, Method of false position and Newton-Raphson method. Principle of least squares – fitting of polynomials.

Interpolation: Finite differences(forward, backward and central difference), Newton's formula for Interpolation, Central difference Interpolation formula (Gauss's & Sterling formula), Lagrange's Interpolation formula, Inverse Interpolation. **(Sastry)**

UNIT-II: NUMERICAL DIFFERENTIATION & INTEGRATION

Differentiation: Cubic Spline Method, Maximum and Minimum values of a Tabulated function

Numerical Integration: Trapezoidal Rule, Simpson's 1/3 Rule and 3/8 Rule. Solutions of linear systems-Direct methods: Matrix Inversion method, Gaussian Elimination method, Modification of Gaussian Elimination method(Gauss-Jordan Method). Iterative methods: Jacobi method, Gauss Seidel method.

Numerical solutions of ordinary differential equations: Solution by Taylor's series, Picard's method of successive approximations, Euler's method (Error estimates for the Euler's method, Modified Euler's method) and Range-Kutta method. **(Das & Sastry)**

UNIT- III: INTRODUCTION TO 'C' LANGUAGE

Character Set, C tokens, Key words and Identifiers, Constants and Variables, Data types, Declaration of variables. Operators and expressions: Arithmetic, Relational, Logical, Assignment, Increment and Decrement operators, Conditional, Bitwise and special operators. Precedence in evaluating arithmetic operators. Reading and Writing a character. IF, IF-ELSE, Nesting IF-ELSE, ELSE IF ladder and GOTO statements, WHILE, DO, FOR loop statements. Simple programs

(Balaguruswamy & Kanethkar)

UNIT- IV: PROGRAMMING IN C -LANGUAGE

Arrays: One and Two dimensional arrays, Declaring and initializing string variables. Reading strings from terminal and writing strings to screen. User defined functions: definition of functions, Return values and their types. Function calls and function declaration. Pointers: Declaring and initializing pointers, Accessing a variable through its pointer. C- Programming: Linear regression, Sorting of numbers, Calculation of standard deviation and matrix multiplication

(Balaguruswamy & Kanethkar)

BOOKS FOR STUDY:

1. Numerical Methods. B.S.Gopal& S.N.Mittal
2. Numerical Methods. S.Sastry
3. Mathematical Physics. H.K.Das, S.Chand & Co.
4. Programming in ANSI C, E Balaguruswamy, TMH New Delhi, 2004.
5. Let us C, Yashavant Kanetker, BPB Publications, New Delhi, 1999.

ADIKAVI NANNAYA UNIVERSITY
M.Sc. Physics
II Semester
(w.e.f 2016-17 Admitted batch)
P204 : NUCLEAR AND PARTICLE PHYSICS

UNIT - I
INTRODUCTION :
Objective of Studying Nuclear Physics, Nomenclature, nuclear radius, mass & Binding energy, angular momentum, magnetic dipole moment, Electric quadrupole moment, parity and symmetry, domains of instability, mirror nuclei.
NUCLEAR FORCES : Simple theory of the deuteron, scattering cross-sections, qualitative discussion of neutron- proton and proton- proton scattering, exchange forces, Yukawa's Potential, Characteristics of Nuclear Forces. 15 hrs

UNIT - II
NUCLEAR MODELS . Liquid drop model:, Weissacker's semi-emperical mass formula, Mass – parabolas. Nuclear shell model : Spin orbit interaction, magic numbers, prediction of angular momenta and parities for ground states, Collective model
NUCLEAR DECAY : Fermi's Theory of - decay, parity violation in -decay, detection and properties of neutrino. Energetics of gamma deacay, selection rules, angular correlation, Mossbauer effect.
15 hrs

UNIT – III
NUCLEAR REACTIONS : Types of reactions and conservation laws, the Q – equation, Optical model.
NUCLEAR ENERGY Stability limit against spontaneous fission, Characteristics of fission, delayed neutrons, Four factor formula for controlled fission, Nuclear fusion, prospects of continued fusion energy.
DETECTING NUCLEAR RADIATION: Interaction of radiation with matter. Gas filled counters, scintillation detectors, semiconductor detectors, energy measurements, buble chamber, magnetic spectrometers. 10 hrs.

UNIT - IV
ACCELERATORS: Electrostatic accelerators, cyclotron accelerators, synchrotrons, linear accelerators, colliding beam accelerators.
ELEMENTARY PARTICLE PHYSICS: Particle interactions and families, conservation laws (energy and momentum, angular momentum, parity, Baryon number, Lepton number, isospin, strangeness quantum number(Gellmann and Nishijima formula) and charm), Elementary ideas of CP aand CPT invariance, Quark model.

TEXT BOOKS :. "Introductory Nuclear Physics" Kenneth S. Krane

Reference Books:

1. "Introduction to Nuclear Physics " Harald A.Enge
2. "Concepts of Nuclear Physics " Bernard L.Cohen.
3. " Introduction to High Energy physics" D.H. Perkins
4. " Introduction to Elementary Particles" D. Griffiths