Each semester contain one theory and one practical in each Semester. Each theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of at least 4 hours duration in one day and shall carry 50 marks. The following syllabi is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units.

B.Sc.-III (Sem.-V)

Unit-I: Origin of Quantum Mechanics

Historical Background: Failure of classical wave theory in explaining Black body radiation and Photoelectric Effect; Compton Effect Qualitative explanation only, Assumptions of Planck's Quantum Theory, Wave Particle Duality, Matter Waves: De Broglie Hypothesis, Davisson Germer experiment, Concept of Wave Packet, Phase velocity, group velocity and relation between them, Heisenberg's uncertainty principle: Different forms of uncertainty principle; Thought experiments: single slit diffraction and Gamma ray microscope

Unit-II: The Schrodinger equation and its applications

Wave function and its physical significance, Schrodinger time dependent equation, Separation in time dependent and time independent, Operators in quantum Mechanics, Eigen functions and Eigen values, Particle in one dimensional and three dimensional box (Energy eigen values), Qualitative analysis of potential barrier Tunneling effect), Simple Harmonic Oscillator (Qualitative analysis of Zero point energy)

Unit-III: Atomic and Molecular Spectroscopy

Vector Atom Model: Quantum Numbers, Stern Gerlach, experiment; selection rules, l-s and j-j coupling, Types of spectra – Emission & absorption spectra.

X-rays: Continuous X-ray spectrum, Duane and Hunt's law, characteristic X-ray spectra, Mosley's law.

Raman Effect: stoke's and anti-stoke's lines, Quantum, theory of Raman effect, Experimental arrangement for Raman Spectroscopy.

Unit-IV: Nuclear Physics

Detection of charged particles; G. M. counter, Binding energy and Mass defect, stability of nuclei, Alpha Decay: Range of Alpha particles, Geiger – Nuttal law and Gamow's explanation of alpha decay (qualitative), Beta decay: Types and Pauli's Neutrino Hypothesis, Nuclear Fission, Nuclear fusion (concepts only), Nuclear reactors.

Unit-V: Hybrid parameters

Low frequency equivalent of CE amplifier & its analysios, Bais stability & thermal runway (qualitative). General principles of amplifier classification, RC coupled amplifier, equivalent circuits & gain at low, medium & high frequency (qualitative), gain-frequency response. Noise & distortion in electronic circuits.

Unit-VI: Feedback in amplifiers

Negative feedback, advantages of negative feedback, positive feedback. Phase shift, Wein bridge, Hartley & Colpits Oscillators. Multi-vibrators - astable, monostable & bistable.

Practicals:

1. To study RC coupled amplifier- variation of gain with load.
2. To study phase shift oscillator.
3. To study Wein bridge oscillator.
4. To study Hartlay oscillator.
5. To study Colpits oscillator.
6. To determine 'e' by Millikan's oil drop experiment.
7. To determine 'e' by Thomsons method.
8. Determination of Rydberg's constant.
9. To study absorption spectrum of Iodine vapors.
10. To study Raman spectrum.
11. To identify elements in optical line spectrum.
12. To determine absorption coefficient of material for gamma rays.
13. Determination of Hybrid parameters.
14. Study of monostable multivibrator.
15. Study of astable multivibrator.
16. Study of an amplifier - with & without feedback.
17. Determination of Plank's Constant by using LED.
18. To study characteristics of Zener diode.
19. Study of LED characteristics.
20. Study of characteristics of Laser.
21. Study of Emitter follower.

B.Sc.-III (Sem.-VI)
STATISTICAL MECHANICS AND SOLID STATE PHYSICS

UNIT-I: Statistical Mechanics-I

Phase space, unit cell, microstates, macrostates, energy states, density of energy states, probability & thermodynamic probability, principle of equal a priori probabilities, most probable distribution, Boltzman entropy relation. Maxwell Boltzman statistics, and its application to molecular speed distribution, Average speed, rms speed & most probable velocity.

UNIT-II: Statistical Mechanics-II

Distinguishable & indistinguishable particles, concepts of boson &fermions. Bose – Einstein statistics: Thermodynamic probability, most probable distribution, application of BE statistics to black body radiation. Fermi- Dirac distribution: Thermodynamic probability, most probable distribution, Fermi function, Fermi energy & Fermi temperature.

UNIT-III: Crystallography

Solids: Amorphous and Crystalline Materials; Unit Cell, Millar Indices, Reciprocal Lattice, Coordination Number, Types of Lattices: Diffraction of x-rays by Crystals. Bragg's Law: Determination of lattice parameters of NaCl crystal, Defects in solids – points, line & plane defects.

UNIT–IV: Electrical Properties of Materials

Motion of electron: Free electrons; conduction electrons, electron collision; mean free path, conductivity & Ohm's law; density of states; concept of Fermi energy.

Band structure: Electron in periodic potential, nearly free electron model (qualitative), energy band, energy gap, metals, isulators and semiconductors.

UNIT-V: Magnetic Properties of Materials

Atomic magnetic moment; magnetization vector; magnetic susceptibility; Dia -, Para-, and Ferromagnetic Materials; Classical Langevin Theory of dia and Paramagnetic Domains; Quantum Mechanical Treatment of Paramagnetism; Curie's law, Weiss's law; Hysteresis and Energy Loss.

UNIT-VI: Superconductivity & Nano Technology

Superconductivity: Introduction to Superconductors; Critical Temperature; Critical magnetic field; Meissner-Effect; Type I and type II Superconductors, Idea of BCS theory (No derivation), Cooper pair; Applications of superconductors.

Nano Technology: Introduction to nano size materials, brief History of Nano materials, Effect of reduction of dimensions on physical properties; quantum size effect; Applications of nano materials in different fields.

REFERENCE BOOKS:

1. Thermodynamics and statistical mechanics-Brijlal Subramanium
2. Statistical Mechanics - An Elementary Outline -Avijit Lahiri -Universities Press
3. Statistical and Thermal physics - By Lokanathan, R.S. Gambhir,
4. Fundamentals of statistical and thermal physics - By F.Reif
5. Perspectives of modern physics - By A. Beiser
6. Fundamental of Statistical Mechanics - By B.B. Laud
7. A primer of Statistical Mechanics - By R.B. Singh
8. Statistical Mechanics - By Gupta, Kumar
9. Solid State Physics, S.O.Pillai, 3rd Edition, New Age International (P) Ltd, Publisher, (1999).
10. Solid State Physics – By Kakani and Hemrajani, S. Chand Publication.
11. Solid State Physics - By Saxena, Gupta and Saxena, Pragati Prakation.
12. Introduction to Solid State Physics, Charles Kittel, John Wiley and Sons, 7th Edition.
13. Solid State Physics, A.J.Dekker, Macmillan India Ltd, (1998).
14. Solid State Physics, R.K. Puri, V.K. Babbar, S. Chand Publication.
15. Problems in Solid State Physics, S.O. Pillai, New Age International (P) Ltd.
16. Solid State Physics, Palanyswamy.
17. Solid State Physics, David, Snoke, Pearson Publication.
18. Introduction to Nanoscience & Nanotechnology by K. K. Chattopadhyay and A. N.Banerjee, Publisher: PHI Learning and Private Limited
19. Nanotechnology, Rakesh Rathi, S Chand & Company, New Delhi
20. Nanotechnology: Principles and Practices by Sulbha K Kulkarni, Capital Publishing Co. New Delhi.

References:

1. IGNOU: Practical Physics Manual
2. Saraf: Experiment in Physics
3. S.P. Singh: Advanced Practical Physics
4. Melissons: Experiments in Modern Physics

Practicals:

1. To study crystal models and identification of crystal planes.
2. To study Characteristics of Photocell
3. To determine Planck's constant using photocell
4. To determine energy gap of semiconductor using four probe method.
5. To determine activation energy of Thermister.
6. To determine energy gap of semiconductor using reverse bias method
7. To study hysterisis losses in transformer core and plot B-H curve.
8. To measure magnetic susceptibility of solids.
9. To study thermo emf using thermocouple.
10. To Determination of temperature coefficient of resistance of platinum using platinum resistance thermometer.
11. To determine lattice parameter using X-ray diffraction pattern.
12. To determine half-life period of radioactive substance by GM counter
13. Determination of dislocation density in alkali halide crystals.
14. Demonstrations- Any 4 demonstrations equivalent to 2 experiments
15. Mini project equivalent to 2 experiments.
16. Computer aided demonstrations (Using computer simulations or animations) (Any 2 demonstrations equivalent to 2 experiments)
17. To study characteristics of Photo diode.
18. To study Zener regulated power supply.
19. Study of transistorized regulated power supply, series pass transistor.
20. Determination of velocity of sound by using sonometer wire.
21. Determination of velocity of ultrasonic wave in liquids.
22. Determination of Band gap energy of a pn junction / zener diode.