Department Name: Physics
Semester - III

Course Title: Thermal and Statistical Physics	**Course Code:**HCT3.1
Total Contact Hours: 60 Hours	**No. of Credits:** 04
Internal Assessment Marks: 20	**Duration of SEE :**03 Hours
SEE Marks: 80	

Course Outcomes (COs):
At the end of the course, students will be able to:
1. Apply the basic ideas in thermodynamics and statistical mechanics to physical situations.
2. Use various partition functions to determine thermodynamic potentials.
3. Apply various distribution functions to physical systems.
4. Analyse thermodynamical systems using fluctuations and related phenomenon.
5. Analyse phase equilibria in various thermodynamical situations.

Unit -115 hours

Basic thermodynamics and statistical concepts
Laws of thermodynamics and their consequences, Thermodynamic potentials, Maxwell's relations and their applications, Microscopic and Macroscopic states, Phase space and μ-space, Ergodic hypothesis and Liouville's theorem (proof). Probability distribution – Binomial, Poisson and Gaussian distributions, Ensemble – Probability distributions in Microcanonical, canonical and grand canonical ensembles. (1,2,4)

Unit -215 hours

Classical statistics
Concept of partition function, Partition function of a system of particles, The translation partition function, Gibbs paradox – Sacker-Tetrode equation, Boltzmann equipartition theorem, Rotational partition function, Vibrational partition function, Electronic partition function, Maxwell-Boltzmann distribution – velocity & energy, Deduction of average speed, mean square speed and most probable speed by Maxwell-Boltzmann distribution. (Ref. 2,3,4)

Unit -315 hours

Quantum statistics
The symmetry and anti symmetry of the wave functions, Bosons and Fermions, Bose-Einstein and Fermi-Dirac distributions. Ideal Bose systems: Photon gas – Radiation pressure, Radiation density and emissivity, Bose-Einstein condensation, Phonon gas - specific heat of solids by Einstein and Debye's theories. Ideal Fermi Systems: Fermi energy, Mean energy of Fermions at T=0K, Fermi Gas in Metals, Atomic nucleus as an ideal Fermion gas, Electronic specific heat in metals, Pauli paramagnetism, (Ref. 1,4)

Unit -415 hours

Fluctuations and Phase Equilibria
Fluctuations in canonical, grand canonical and microcanonical ensembles. The Brownian motion and Langevin equation. Random walk, diffusion and the Einstein relation for mobility. Onsager reciprocity relations. Thermoelectric phenomena. (Ref. 2,4)
Equilibrium conditions, First- and second-order phase transitions, phase diagram, Ising model, Clausius-Clapeyron equation, Liquid-Vapour equilibria: vapour pressure curve, Phase transition in ferromagnetic materials, Liquid helium, Chemical equilibrium, Saha-Ionisation formula. (Ref.1,4)

Prescibed Books:
1. Fundamentals of Statistical Mechanics by B.B. Laud, New Age International Pvt. Ltd., Second Edition, 2012.
2. Fundamentals of Statistical Mechanics and Thermal Physics by F. Reif, Mc Graw Hill Book Company, New York

References:
1. Statistical Mechanics and Properties of Matter by E.S.R. Gopal, Ellis Horwood Limted Chichester Publisher, 1974.
2. Thermal Physics by by S.C. Garg, R.M. Bansal and C.K. Ghosh, Mc Graw Hill Education (India) Private Limited, 2012.

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Department Name: Physics
Semester - III

Course Title: Analytical Techniques and Instrumentation	**Course Code:** HCT3.2
Total Contact Hours: 60 Hours	**No. of Credits:** 04
Internal Assessment Marks: 20	**Duration of SEE :**03 Hours
SEE Marks: 80	

Course Outcomes (COs):
At the end of the course, students will be able to:

1. Explain the fundamentals of analytical Instrumentation techniques.
2. Analyse vibrations of molecules using IR and Raman spectroscopic techniques.
3. Analyse atomic absorption, emission & photoluminescence of chemical species using absorption and emission spectroscopy.
4. Analyse the crystalline and morphological features of chemical species using spectroscopic techniques.
5. Determine electrical, magnetic, nuclear and thermal properties of chemical species using suitable techniques.

Unit -115 hours

Fundamentals of Analytical Instruments:
Types of chemical analysis, Elements of analytical instrument, Sensors and transducers, Classification of transducers, Performance characteristics of Transducers, Smart sensors, Signal processing in analytical instruments, Read out systems, types of instrumental methods, classification of analytical instruments.
Performance requirements of analytical instruments: Errors in chemical analysis, Types of Errors, Accuracy and precision, Significant figures, Application of statistical methods, Signal to noise ration. Sensitivity, Selectivity, Specificity, Resolution, Range, Limit of detection, Linearity. (Ref: 1)

Unit -215 hours

Infrared and Raman Spectroscopy:
Infrared Absorption Spectroscopy: Range of Infrared Radiation, Modes of vibrations, Basic components of IR spectrophotometers (Radiation sources, monochromators, slits, mirrors, sample cells, sampling substance, and detectors) Types of IR spectrophotometers: Optical null method and Ratio recording method; sample handling techniques, Fourier transform infrared spectrometer. (Ref: 1,2)
Raman Spectroscopy: Raman effect: Principle, characteristic properties of Raman lines, Raman spectrometer (Sources, sample chamber, Detectors), PC based Raman spectrometer, FT Raman spectrometer, Applications, comparison between Raman and Infrared Spectroscopy. (Ref: 1,2)

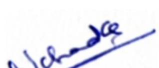
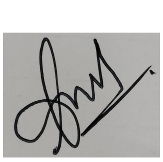
Unit -315 hours

Absorption and Emission Spectroscopy:
UV-Visible Absorption spectroscopy: Beer-Lamberts law, construction and working of single and double beam absorption spectrometers, applications.
Atomic absorption spectroscopy: Principle, Instrumentation (Radiation sources, Burners and flames, Atomization, Optical system, Electronic system, Sampling system), Applications.
Atomic emission spectrophotometer: Instrumentation, Plasma excitation sources (Direct coupled plasma, Inductively coupled plasma, Microwave induced plasma).
Photoluminescence: Principles of fluorescence and Phosphorescence, Instrumentation of spectrofluorimeter

Unit -415 hours

X-ray, Electron Magneto spectroscopy:
X-ray Diffraction: Bragg's law, X-ray diffraction methods and associated instrumentation, Applications.
Electron spectroscopy: Auger Electron Spectroscopy (AES), Scanning Electron Microscopy (SEM); Transmission Electron Microscopy (TEM). Scanning Tunnelling Electron Microscopy (STEM), Atomic Force Microscopy (AFM).
Magneto Spectroscopy: Vibrating-sample magnetometer (VSM), Nuclear Magnetic Resonance spectrometer (NMR), Electron Spin Resonance (ESR).

1. Handbook of Analytical Instruments, R.S. Khandpur, 3rd Edition, Tata McGraw-Hill, (2015).
2. Instruments Methods of Chemical Analysis, Chatwal and Anand, Himalaya Publishing House, (2019).
3. Instrumental Method of Analysis, Willard, Merritt, Dean and Settle, CBS Publishers and Distributors, Delhi (1986).
4. Principles of Instrumental Analysis, 7th Edition, D. A. Skoog, F. J. Holler, S. R. Crouch, Cengage India Private Limited, (2020).
5. Methods of Experimental Physics, Dudley Williams, Academic press, New York, (1976).
6. Experimental Spectroscopy, Sawyer, Prentice-Hall publisher, (1946).

Department Name: Physics
Semester - III

Course Title: Advanced Condensed Matter Physics	**Course Code:**SCT3.1
Total Contact Hours: 60 Hours	**No. of Credits:** 04
Internal Assessment Marks: 20	**Duration of SEE :**03 Hours
SEE Marks: 80	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Determine physical parameters of solids using reciprocal lattice and band structure models.
2. Determine transport properties of solids using related theories.
3. Analyse dielectric and optical properties of solids using basic principles of physics.
4. Analyse magnetic properties of solids using various theories/models.
5. Explain properties of superconductors based on classical and quantum concepts.

Unit -115 hours
Reciprocal Lattice and Band structure in Solids: Concept of Reciprocal lattice, Method of Construction, Reciprocal Lattice Vectors, Properties of Reciprocal lattice, Reciprocal lattice to SC, BCC and FCC, Bragg's law in Reciprocal Lattice, Brillouin Zones and their construction, Brillouin Zone of BCC and FCC Lattice. (Ref.1 & 2) Nearly free electron model – origin and magnitude of energy gap; Tight Binding Model – Band width and effective mass in linear lattice and cubic lattice; Augmented Plane Wave (APW) method of band structure calculation. (Ref. 2, 3 & 4)
Unit -215 hours
Transport Properties: Boltzmann transport equation, Chamber's Equation, Sommerfeld's theory of electrical conductivity, Thermal conductivity of metals and Widemann –Franz law, Criticism of Sommerfeld's theory, Relaxation time, Mean free path, The additive Nature of Resistivity – Mathiessen's rule, Thermoelectric effects, Magneto-resistance. (Ref.5)
Unit -315 hours
Dielectric and Optical Properties: **Static Fields:** Macroscopic description of static dielectric constant, Static electronic and ionic polarizabilities of molecules, Orientational polarization, Static dielectric constant of gases, Internal field according to Lorentz, Static dielectric constant of solids – Clausius-Mosotti formula. **Alternating fields:** Complex dielectric constant and dielectric losses, Dielectric losses and relaxation time, Classical theory of electronic polarization and optical absorption. (Ref. 6)
Unit -1415 hours
Magnetic and Superconductivity Properties Classification of magnetic materials, Atomic origin of magnetism, Langevin diamagnetism, Paramagnetism - Classical and quantum theories; Magnetism in metals – Spin-paramagnetism, diamagnetism; Ferromagnetism in insulators – Curie-Weiss law, Molecular field theory, Antiferromagnetism and ferrimagnetism, Ferromagnetism in metals, Ferromagnetic domains – Hysteresis curve.(Ref. 3 & 4). Review of superconductivity, Heat Capacity, Energy gap, Microwave and Infrared Properties, Isotope Effect, Thermodynamics of Superconducting Transition, Electrodynamics of Superconductors - London Equations, Coherence Length, Single Particle Tunnelling, Josephson Tunnelling – DC and AC Josephson Effect, Applications. (Ref. 2)
References: 1. Solid State Physics by R. K. Puri & V. K. Babbar, S. Chand Publications. 2. Introduction to Solid State Physics by C. Kittel, Wiley Eastern Ltd 3. Elementary Solid State Physics by M. Ali Omar, Pearson Education. 4. Elements of Solid State Physics by J.P Srivastava, PHI Learning Pvt. Ltd. 5. Solid State Physics by S.L. Gupta and V. Kumar, K. Nath & Co. 6. Solid State Physics by A. J. Dekker, McMillan and Co. Ltd.

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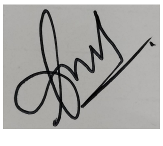


Department Name: Physics
Semester - III

Course Title: Advanced Nuclear Physics	**Course Code:** SCT3.2
Total Contact Hours: 60 Hours	**No. of Credits:** 04
Internal Assessment Marks: 20	**Duration of SEE :**03 Hours
SEE Marks: 80	

Course Outcomes (COs):
At the end of the course, students will be able to:
1. Analyse structure of nuclei using various models.
2. Analyse two nucleon systems and nuclear reactions.
3. Explain fundamentals of heavy ion physics.
4. Use neutron physics to describe various nuclear processes. .
5. Apply various nuclear techniques in advanced nuclear physics.

Unit -115 hours

Two nucleon systems: The ground and Excited states of deuteron, tensor nature of nuclear force and its range. Neutron-proton scattering at low energies, scattering length, Effective range theory in n-p scattering, proton-proton scattering at low energies, Analysis of n-p and p-p scattering, high energy n-p and p-p scattering. Interpretation of n-p and p-p scattering

Nuclear Models Shell model: Evidences for shell structure, energy levels according to harmonic oscillator intermediate potentials - effect of spin-orbit interaction. Shell model Prediction of ground state spin, parity of odd-A nuclei and odd-odd nuclei - Nordheim's rules, magnetic moments of odd-A nuclei Schmidt limits.

Collective model: Introduction, Nuclear deformations, and collective motions of nucleons. Vibrational model- Vibrational excitation and vibrational energy levels for even-even nuclei, rotational model- Nuclear rotational motion and rotational energy spectra for even-even and odd A nuclei.

Unit -2 15 hours

Fermi gas model: Fermi energy of nucleons, Fermi momentum and level density; nuclear matter.

Nuclear reactions: nuclear reactions and cross sections, partial wave analysis of nuclear reactions-expressions for scattering and reaction cross sections and their interpretations - shadow scattering. Resonance theory of scattering and absorption. Breit-Wigner formula for l=0. **Compound nucleus model**: model and continuum theory of cross-section

Optical model - mean free path - optical potential and optical model parameters, optical model at low energy, Kapur-Pierls dispersion formula for potential scattering and experimental results.

Direct Reactions: Transfer reactions - semiclassical description. Theory of stripping and pickup reactions, Plane wave Born approximation (PWBA) - its predictions of angular distributions - modifications - distorted wave Born approximation (DWBA) - spectroscopic factors and their significance.

Unit -3 15 hours

Heavy Ion Physics: Special features of heavy ion reactions. Qualitative treatment of remote electromagnetic interaction Coulomb excitations; close encounters, grazing collisions and particle transfer. Direct and head on collision, compound nucleus and quasi molecule formation**Neutron Physics:** Introduction, Properties of neutron, Classification of neutrons according to energy - neutron sources. Ultrafast neutrons, Neutron detectors, Neutron detection from nuclear reactions. BF3 counters, He-3 proportional counters, fission detectors, activation method for neutron flux measurement. Recoil counters, neutron time of flight technique. Slow neutron detection through nuclear reaction and induced radio activity, slow neutron cross section measurements, neutron monochromators.

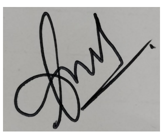
Unit -415 hours

Nuclear fusion process, Controlled thermonuclear reactions. Hydromagnetic equations. Magnetic pressure, pinch effect, magnetic confinement systems for controlled thermonuclear fusion

Nuclear techniques: X-ray Fluorescence (XRF) - Basic principle, instrumentation and application, Neutron Activation Analysis (NAA) - Basic Principle, Instrumentation and application, Proton Induced X-ray Emission (PIXE) - Basic Principle, Instrumentation and application, Positron annihilation - Basic Principle, Sources, Experimental details, angular correlation of annihilation radiation and Fermi momentum of conduction electron in metals, Ion beam analysis-Rutherford back scattering.

References:

1. Nuclear Physics: R R Roy and B P Nigam, John Wiley & Sons, Inc., 1967.
2. Nuclear Physics: D C Tayal, Himalaya Publishing House, Fifth Edition, 2015.
3. The Atomic Nucleus: R D Evans, Tata McGraw Hill Edition, 1955.
4. Physics of Nuclei and Particles: P Mermier and E Sheldon, Volume-II, Academic Press, Inc., 1969.
5. Atomic and Nuclear Physics: S N Ghoshal, S. Chand & Company Pvt. Ltd., 2014.
6. Zweifel P F, 'Reactor Physics', International student Edn. (McGraw Hill, 1973).
7. H R Verma, Atomic and Nuclear Analytical Methods: XRF, Mössbauer, XPS, NAA and Ion-Beam Spectroscopic Techniques. Springer.

Department Name: Physics
Semester - III

Course Title: Optical Spectroscopy	**Course Code:**SCT3.2
Total Contact Hours: 60 Hours	**No. of Credits:** 04
Internal Assessment Marks: 20	**Duration of SEE :**03 Hours
SEE Marks: 80	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Analyse UV and visible spectroscopy of molecules.
2. Analyse fluorescence spectroscopy of molecules.
3. Explain time domain and frequency domain techniques for lifetime measurements.
4. Describe the working of Refractometry, Polarimetry, and Circular Dichroism instrumentation.
5. Explain the development of holograms and theory of non-linear optics.

Unit -115 hours

Ultraviolet and Visible Spectroscopy:

Origin and theory of ultraviolet spectra, Beer-Lambert's law, Types of transitions in inorganic and organic molecules ($\sigma \rightarrow \sigma^*$, $n \rightarrow \sigma^*$, $\pi \rightarrow \pi^*$, $n \rightarrow \pi^*$), The shape of UV absorption curves, Transition probability, Chromophore and related terms: Bathochromic and Hypsochromic shift; Hyperchromic, Hypochromic effect; Auxochrome, Effect of conjugation, solvent effects, Choice of solvents, Instrumentation: construction and working of single and double beam spectrophotometers, Applications.

Unit -215 hours

\Fluorescence Spectroscopy:

Fluorescence, Jablonski Diagram, Characteristics of Fluorescence Emission, Fluorescence Lifetimes and Quantum Yields, Fluorescence Anisotropy, Timescale of Molecular Processes in Solution, Molecular Information from Fluorescence: Emission Spectra and the Stokes Shift, Quenching of Fluorescence, Fluorescence Polarization or Anisotropy, Resonance Energy Transfe;, Intrinsic or Natural Fluorophores, Extrinsic Fluorophores, DNA Probes, Chemical Sensing Probes and Special Probes, other Fluorescent Proteins, Long-Lifetime Probes: Lanthanides, Transition Metal–Ligand Complexes, Proteins as Sensors. Construction and working of Spectrofluorometer: Light Sources, Monochromators, Optical Filters, Detectors.

Unit -315 hours

Refractometry, Polarimetry, and Circular Dichroism:

Refractometry: Refractive index, Effect of wavelength and temperature on RI, Instrumentation of Abbe Refractometer, Applications.

Polarimetry: Optical activity, types of molecules analyzed by polarimetry, Instrumentation of Polarimeter, Applications.

Circular Dichroism Spectroscopy: Circularly polarized light, Optically active molecules, Optically rotator dispersion, Circular dichroism and Instrumentation for measurements, Applications.

Unit -415 hours

Holography and Non-linear optics:

Principle of holography, Recording of the Hologram, Reconstruction of the Image, some distinguishing characteristics of holographs - practical applications of holography.

Harmonic generation - second harmonic generation - phase matching - third harmonic generation Z scan technique - optical mixing - parametric generation of light - self focusing of light, Electro-optic effect.

References:

1. Instruments Methods of Chemical Analysis, Chatwal and Anand, Himalaya Publishing House, (2019).
2. Handbook of Analytical Instruments, R.S. Khandpur, 3rd Edition, Tata McGraw-Hill, (2015).
3. Fundamentals of Molecular Spectroscopic, C N. Banwell and E. M. McCash, Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 5th Edition, (2008).
4. Principles of fluorescence spectroscopy, Joseph R Lakowicz, 3rd Edition, Springer, New York, (2006).
5. Lasers & Nonlinear Optics, Laud B B, New Age International (P) Limited, Publishers, (2011).
6. Nonlinear Optics-Basic Concepts, Mills D L, Narosa Publishing, (1991).

Department Name: Physics

Semester - III

Course Title: Space Research Programs in India and Abroad	**Course Code:**OET3.1
Total Contact Hours: 30 Hours	**No. of Credits:** 02
Internal Assessment Marks: 10	**Duration of SEE : 2** Hours
SEE Marks: 40	

Course Outcomes (COs): At the end of the course, students will be able to:

1. Explain basic ideas of space missions.
2. Recognize major space centers and space scientists in the World.
3. Explain the contributions of ISRO for space missions.
4. Explain the applications of satellite.

Unit -115 hours
Introduction to Space Missions Rockets, types and theirapplications, Orbits - Different types of orbits, Artificial satellites – basic idea and their applications, Introduction to Space Missions, Beginning of Space Missions - World and India, Applications of Space Research, Space crafts, Launching Vehicles. Major Space Centres in the World (at least 10) – brief idea about their location, establishment, capabilities and achievements.
Unit -215 hours
Indian Space Research Organisation (ISRO) About ISRO and its Goals, History of Creation. General Satellite Programmes: The IRS series, The INSAT series. Gagan Satellite Navigation System, Navigation with Indian Constellation (NavIC), Other satellites. Launch vehicles: Satellite Launch Vehicle (SLV), Augmented Satellite Launch Vehicle (ASLV), Polar Satellite Launch Vehicle (PSLV), Geosynchronous Satellite Launch Vehicle (GSLV). Experimental Satellites: Details and applications (Any Five) **Success Stories of Space missions** Earth Observation Satellites: Communication satellites, (Success stories: Apollo 11, Chandrayaan 1, Mars Orbiter Mission (MoM). Proposed space programmes of NASA and ISRO.
References: 1. https://www.britannica.com/topic/NASA 2. https://www.isro.gov.in/

Department Name: Physics
Semester - III

Course Title: Elementary Astrophysics	**Course Code:**OET3.2
Total Contact Hours: 30 Hours	**No. of Credits:** 02
Internal Assessment Marks: 10	**Duration of SEE :**2 Hours
SEE Marks: 40	

Course Outcomes (COs):
At the end of the course, students will be able to:
1. Explain the basics of astrophysics and telescopes.
2. Identify stars and its parameters based on their spectra.
3. Identify various types of galaxies.
4. Describe the structure and evolution of the universe.

Unit -115 hours

Basics of Astrophysics and Telescopes:
Scales and Dimensions, Night Sky, Constellations, Earth, Sun, and the Solar System, Retrograde Motion of Planets, Sidereal Time.
Basic Optics, Types of telescopes. Telescope mounting systems. Optical telescopes, Infrared, Ultraviolet, X-ray and Gamma-ray telescopes. Schmidt telescopes.

Unit -2 **15hours**

Stars, Stellar Spectra, and Classification:
Stellar Spectra, Harvard Classification of Stellar Spectra, HR Diagram, Star Clusters and Association, Distance and Age Determination of Clusters Using Color-Magnitude Diagram, Solar System, Solar Atmosphere (Photosphere, Chromosphere, Corona).

Galaxies and the Universe:
The Milky Way – our galaxy, Classification of galaxies, Origin and evolution of galaxies, Measuring galaxy properties, The distances to other galaxies, The structure of the Universe, The evolution of the Universe.

References:

1. Introduction to Stellar Astrophysics, E. Bohm-Vitense, 3rd Volume, CUP, 1989.
2. Astrophysics and Stellar Astronomy, T.L. Swihart, Wiley 1968.
3. An Introduction to Astrophysics Baidyanath Basu, PHI.
4. A Text book of Astrophysics and Cosmology, V.B. Bhatia, New Age.
5. Stars and Galaxies, K.D. Abhyankar, University Press.
6. An introduction to Astrophysics and Cosmology by Andrew Norton – 2016

Department Name: Physics
Semester - III

Course Title: Thermal and Statistical Physics Lab	**Course Code:**HCP3.1
Total Contact Hours: 64 Hours	**No. of Credits:** 04
Internal Assessment Marks: 20	**Duration of SEE :**04 Hours
SEE Marks: 80	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Design an experiment / a computation technique in statistical physics.
2. Conduct an experiment / perform a computation in statistical physics.
3. Analyse data and interpret the results related to statistical physics.

<u>List of Experiments</u>

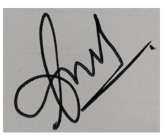
1. Study of Binomial distribution.
2. Study of Poisson distribution.
3. Study of Gaussian Distribution.
4. Study of variation of MB, BE and FD statistics at different temperatures- Computation.
5. Study of Bose-Einstein condensation - Computation.
6. Study of theories of specific heat – Computation.
7. Specific Heat in Metals.
8. Debye temperature of solids.
9. Study of Black body Radiation.
10. Measurement of Planck's constant.
11. Study of Seeback and Peltier effects.
12. Fourier analysis studies.
13. Measurement of Magnetic susceptibility.
14. Measurement of Curie temperature (Magnetic/Electrical).
15. Measurement of thermal conductivity.

Note:

1. Minimum of EIGHT computations must be carried out.
2. Experiments may be added as and when required with the approval of BoS.

References:

1. University Practical Physics by D.C. Tayal, Himalaya Publishing House, First Millenium Edition, 2000.
2. Advanced Practical Physics for students by B.L. Flint and H.T. Worsnop, Asia Publishing House, 1971.
3. A Text Book of Practical Physics, I. Prakash & Ramakrishna, Kitab Mahal, 11th Edition, 2011.
4. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, Heinemann Educational Publishers, 4th Edition, 1985.



Department Name: Physics
Semester - III

Course Title: Analytical Techniques & Instrumentation Lab	**Course Code:** SCP3.2
Total Contact Hours: 60 Hours	**No. of Credits:** 04
Internal Assessment Marks: 20	**Duration of SEE :**04 Hours
SEE Marks: 80	

Course Outcomes (COs):
At the end of the course, students will be able to:
1. Design an experiment / a computation technique to measure material properties.
2. Conduct an experiment / perform a computation to measure material properties.
3. Analyse data and interpret the results related to material properties.

List of Experiments

1. Determination of ‘g’ factor using Electron spin resonance spectrometer.
2. Fourier analysis of different complex waves, existence of different harmonics and measure their relative amplitudes.
3. Study of the Dispersion relation for “Mono-atomic Lattice”. Determination of the Cut-off frequency and Comparison with theory.
4. Study of the Dispersion relation for the Di-atomic Lattice, Acoustical mode and Energy Gap. Comparison with theory.
5. Measurement of numerical aperture and acceptance angle of the given optical fiber.
6. Determination of Dielectric constant of given liquid.
7. Determination of Dielectric constant of given solid.
8. Measurement of Dipole moment of Organic molecules by Solvatochromic technique-computation.
9. Identification of type of vibrations in organic molecules by IR spectroscopic technique and determination of force constant-computation.
10. Design of simple pendulum experiment using ExpEyes kit.
11. Simulation of range of heavy ions in materials using SRIM software.
12. Determination of lattice constant of a given powder XRD pattern of a sample.
13. Determination of size of the NPs using Debye-Scherrer method.

Note:

1. Minimum of EIGHT computations must be carried out.
2. Computations may be added as and when required with the approval of BoS.

References:

1. University Practical Physics by D.C. Tayal, Himalaya Publishing House, First Millenium Edition, 2000.
2. Advanced Practical Physics for students by B.L. Flint and H.T. Worsnop, Asia Publishing House, 1971.
3. A Text Book of Practical Physics, I. Prakash & Ramakrishna, Kitab Mahal, 11th Edition, 2011.
4. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, Heinemann Educational Publishers, 4th Edition, 1985.