# Kumaun University Nainital
# M. Sc. Syllabi in Physics
# (Session 2017-18 Onwards)
# (Total Marks = 2000)

## Semester System Course Structure

**(Total Four Semesters, 100 marks in each Paper followed by practical carrying 100 marks each in each Semester and Grade system in dissertation/project)**

**(100=75 marks external+ 25 marks internal for each paper)**

**Semester–wise Distribution of Papers with Marks**

## I. First Semester :

| | | |
|---|---|---|
| Paper 1: Mathematical Methods | (PHY-4911) | 100 Marks |
| Paper 2: Classical Mechanics | (PHY-4912) | 100 Marks |
| Paper 3: Quantum Mechanics | (PHY-4913) | 100 Marks |
| Paper 4: General Theory of Relativity and Cosmology | (PHY-4914) | 100 Marks |
| Paper 5: Communication Electronics | (PHY-4915) | 100 Marks |
| Practical | (PHY-5181) | 100 Marks |
| | Total = | 600 Marks |

## II. Second Semester :

| | | |
|---|---|---|
| Paper 6: Statistical Mechanics | (PHY-4921) | 100 Marks |
| Paper 7: Atomic and Molecular Spectra | (PHY-4922) | 100 Marks |
| Paper 8: Electrodynamics | (PHY-4923) | 100 Marks |
| Paper 9: Digital Electronics and Computer Architecture | (PHY-4924) | 100 Marks |
| Practical | (PHY-5281) | 100 Marks |
| | Total = | 500 Marks |

## III. Third Semester :

| | | |
|---|---|---|
| Paper 10: Advanced Quantum Mechanics | (PHY-4931) | 100 Marks |
| Paper 11: Nuclear Physics | (PHY-4932) | 100 Marks |

| | | |
|---|---|---|
| Paper 12: Elementary Particle Physics | (PHY-4933) | 100 Marks |
| Paper 13: Condensed Matter Physics | (PHY-4934) | 100 Marks |
| Paper 14: Plasma Physics | (PHY-4935) | 100 Marks |
| Practical | (PHY-6381) | 100 Marks |
| | Total = | 600 Marks |

## IV. Fourth Semester :

| | | |
|---|---|---|
| Paper 15: Special Paper (Part I) | | |
| (a) Advanced Electronics I | (PHY-4941) | 100 Marks |
| (b) High Energy Physics I | (PHY-4942) | 100 Marks |
| (c) Spectroscopy I | (PHY-4943) | 100 Marks |
| (d) Astrophysics I | (PHY-4944) | 100 Marks |
| (e) Advanced Condensed Matter Physics I | (PHY-6405) | 100 Marks |

**Paper 16: Special Paper (Part II)**

| | | |
|---|---|---|
| (a) Advanced Electronics II | (PHY-4951) | 100 Marks |
| (b) High Energy Physics II | (PHY-4952) | 100 Marks |
| (c) Spectroscopy II | (PHY-4953) | 100 Marks |
| (d) Astrophysics II | (PHY-4954) | 100 Marks |
| (e) Advanced Condensed Matter Physics II | (PHY-4955) | 100 Marks |

Paper 17: Dissertation / Project work with Grade System (Out of Maximum 100 marks)

| Marks | Grade |
|---|---|
| **91 or above** | **A+** |
| **81 to 90** | **A** |
| **71 to 80** | **B+** |
| **61 to 70** | **B** |
| **51 to 60** | **C+** |
| **41 to 50** | **C** |
| **40 or Less** | **FAIL** |

**Practical 100 Marks**

**Total = 300 Marks**

**Note: Only those special papers will be allowed where at least three experiments are available.**

**IMPORTANT- Educational tour for scientific laboratories and physics research institutes has been included as per university**

**norms in the syllabus of M. Sc. (Physics). A Tour report will be submitted to the HOD after visit.**

## M.Sc. Physics Syllabus (Semester System 2011 -12 Onwards)
## Kumaun University Nainital
## IVth Semester

**Paper - 15 Special Paper I (Any one of the followings)**

**(a) Advanced Electronics**

**(b) High Energy Physics**

**(c) Spectroscopy**

**(d) Astrophysics**

**(e) Advanced Condensed Matter Physics**

**Practical**

# Syllabus for M. Sc. Physics IV Semester
# Paper- 15 (a)
### Special Paper – I Part
# (PHY-4941) Advanced Electronics – I 75 Marks

**Unit I: Operational Amplifier**

Basic operational Amplifier, Inverting & Non inverting OP – AMP, Common Mode Rejection Ratio (CMRR), Summing Amplifier, Voltage follower, Current to voltage, Voltage to current converter, Integrator, Differentiator, Log – Antilog Amplifier, Circuit type of OP – AMP 741, Operational Amplifier parameters, Effects of offset, Frequency response and Stability, Comparators, Discriminators, sample & hold circuits, Zero crossing detector, Precision rectifier, Waveform generators, OP -AMP as astable, Monostable and bistable Multivibrater, Regenerative comparator (Schmitt trigger), IC 555 timer.

**Unit II: Power Supply Regulation**

Servomechanism, Regulation using OA, Zener reference source, The 723 regulator, Current regulator, Short circuit and over load protection, Precision rectifier, IC regulated power supply. Three terminal voltage regulators, Dual Polarity regulated power supplies using 78 XX and 79 XX series regulators (Basic ideas only), Switched mode power supply( SMPS), Active filter, PLL.

**Unit III: Microwave production and Microwave Communications**

Limitation of conventional electronic devices at UHF, Microwave frequencies, Principle of velocity modulation. Reflex klystron. Theory and uses of cavity magnetron, PIN & GUNN diode, Detection of microwave, measurement of power, Advantages and disadvantages of Microwave transmission, loss in free space, propagation of microwaves, atmospheric effects on propagation, Fresnel zone problem, ground reflection, fading ,sowlles, detectors, components, antennas used in microwave communication system.

**Unit IV: Digital and Optical Communication**

Digital signal processing, Image processing (Basic ideas only), Pulse Modulation systems, Pulse Amplitude Modulation, Pulse Width Modulation, Pulse position modulation, Pulse code modulation, Delta modulation Frequency division multiplexing (FDM), Basic idea of digital telemetry.

Principle of optical communication, Different modes of propagation of E. M. Wave through optical fibre, Brief concept, classification of fibres and ray path, Advantages of multimode fibres and cladding , Optical Fibre connectors, Optical Fibre communication Receiver, Brief Introduction , Signal path through optical data link, Block diagram of optical Receiver, Advantages of optical communication, Light propagation in cylindrical wave guide.

**Book Recommended:**

Coughlin: - Operational Amplifiers and linear Integrated Circuits Rajaraman: - Introduction to digital Computer Design (Prentice Hall)
Schilling and Belov: Electronics circuits Discrete and Integrated Sloan:
Computer Hardware and Organisation (Galgotia Publication)
Vishwanathan Mehta: - Electronics for Scientists and Engineers
Roychaudhary and Jain: Operational amplifier and Linear Integrated Circuits
Taub and Schiling: - Principles of Communication systems
Simon Gaykuti: Communication Systems (John Wiley & Sons Inc. 1994)

# Syllabus for M. Sc. Physics IV Semester
# Paper 15(b)
### Special Paper – I Part
# (PHY-4942) High Energy Physics – I 75 Marks

**Unit I:** **Quantization of Scalar Fields**

Lagrangian Formulation, Hamiltonian and momentum densities, Neutral and Charged scalar fields and their quantization, Momentum representation and frequency splitting, Identification of various particle operators, Charge operator, Algebra of field operators, Invariant delta function and its representations, Covariant commutation relations and their properties.

**Unit II:** **Quantization of Spinor Field**

Lagrangian formulation for Spinor field, Hamiltonian and momentum densities, Quantization of Spinor Field, Momentum representation and frequency splitting, Identification of various particle operators, Charge operator for Spinor field, Algebra of Spinor field operators, Covariant form of anti-commutation relations.

**Unit III:** **Quantization of Electromagnetic Field**

Classical electromagnetic field theory and its gauge formulation, Covariant Lagrangian formulation for EM field, Quantization of EM field, Momentum representation and frequency splitting, Identification of various particle operators, Concept of longitudinal, temporal and transverse photons, Covariant commutation relations for EM potential operators, Problems with temporal photons and Lorentz condition, Resolution through Gupta- Bleular formulation.

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**Unit IV:** **Propagators and Interacting Fields**

Meson Propagator, Fermion Propagator, Photon Propagator, Operator products (Normal, Dyson and Chronological T-products), Wicks Theorem and Reduction of S-matrix for the case of QED,

Representation and description of various first and second order processes in QED using S-matrix expansion, Feymann diagrams and Feynman Rules in QED, Compton scattering, Moller scattering, Bhabha scattering, Electron self energy, Photon self energy, vacuum configuration in QED, Renormalization.

**Books recommended**


L. Ryder: Quantum Field Theory
B.K. Agarwal : Quantum Mechanics and Field Theory
F Mandel and Shaw: Quantum Field Theory
P.Roman: Quantum Field Theory
A. Das : Quantum Field theory
M. E. Peskin, D.V. Schroeder: An Introduction to Quantum Field Theory
B.S.Rajput : Advanced Quantum mechanics


# Syllabus for M. Sc. Physics IV Semester
# Paper 15(c)
### Special Paper – I Part
# (PHY-4943) Spectroscopy -I 75 Marks

**Unit I:** **Rotational Spectra**

Rotational energy level populations, Linear, Symmetric, Spherical and asymmetric top molecules, Rotational selection rules for linear molecules, Stark effect in molecular rotation spectra, Molecular rotation – nuclear spin coupling, Positive and negative character of the wave functions of linear molecules, Symmetric – antisymmetric character and statistical weight of homo-nuclear linear molecule.

**Unit II:** **Vibrational Spectra**

Vibration spectra of poly atomic molecule, Coupling of rotation and vibration, Perpendicular and parallel bands, Normal modes of vibration and their analysis in Cartesian coordinates, Normal coordinates and their internal coordinates, Calculation of vibrational frequencies and force field of $H_2O$ and $CO_2$ molecules, Anharmonicity, Aegenerate and non degenerate vibrations, Inversion doubling, Quantized Vibrational motion of polyatomic molecules.

**Unit III:** **Molecular symmetry and Group theory**

Symmetry properties of molecules, Symmetry element, Symmetry operation and point group, Character table, Group theory: representation of a group, Reducible and irreducible representations, LCAO coefficient of a polyatomic molecule, Huckel approximation, Overlap and resonance integrals, Wheal's approximation.

**Unit IV:** **Electronic Spectra**

Spectroscopy of Diatomic and Polyatomic Molecules: Coupling of Electronic and Rotational motion in Diatomic Molecules and Rotational structure of $1\pi$ - $1\Sigma$ and $1\Sigma$ - $1\Sigma$ transitions. Vibronic interaction and Herzberg Teller theory for absorption spectrum of benzene vapour, Single vibronic level spectroscopy and lifetime of vibronic levels in benzene, Quantum yield, Kasha Rule and the concept of nonradiative transtions in molecules, Jablanski diagram and qualitative treatment of small molecule and large molecule limit for nonradiative transitions.

**Books recommended:**


Barrow G.M :Introduction to Molecular spectroscopy; McgrawHill co
Herzberg G :Infrared and Raman Spectra of Polyatomic Molecules; Von Nostrand
Herzberg G :Spectra of Polyatomic Molecules; on Nostrand.
J.R.Lackowicz: Principle of Fluorescence Spectroscopy.
King G : Molecular Spectroscopy.
King G.W :Spectroscopy and Molecular Structure.
C.N. Banwell : Fundamenals of Molecular Spectroscopy.


# Syllabus for M. Sc. Physics IV Semester
# Paper 15(d)
### Special Paper – I Part
# (PHY-4944) Astrophysics –I 75 Marks

**Unit I: Equilibrium and stability of stars**

Hydrostatic equilibrium, virial Theorem, Polytrophic indices, Lane- Emden equation LTE, Radiative equilibrium, stability condition for convective and radiative equilibrium.

**Unit II: Interior properties of stars**

Continuous spectrum of star, Stellar opacity, Limb darkening and blanketing theory of Fraunhofer lines, curve of growth and line broadening .

**Unit III: Cold stars, their birth and properties**

Elementary theory of white dwarfs, Chandrashekhar's limit for white dwarf stars, Neutron stars their birth and properties, Discovery of pulsars, Black holes and black hole candidates.

**Unit IV: Galaxies and Quasi-stellar objects**

Classification of galaxies, Distributions of stars in the Milky way, Morphology, Kinematics, Interstellar medium, Galactic center, External galaxies, spiral structures, Dark matter in spiral galaxies, Galactic rotation, Theory of AGNs, Syferts, Quasars and their energy generation and

redshift anomaly, Different AGN models, radio lobes and jets, Gamma ray bursts, BL – Lac objects.

**Books Recommended**:


Abhyankar K.D. : Astrophysics, Galaxies and Stars
Baidyanth Basu : An Introduction to Astrophysics
Motz : Astrophysics


# Syllabus for M. Sc. Physics IV Semester
# Paper 15(e)
### Special Paper – I Part
# (PHY-4945) Advanced Condensed Matter Physics –I 75 Marks

**Unit I:** **Crystal Symmetry**

Point group and space group, External symmetry elements of a crystal: axis of symmetry, Plane of symmetry (mirror plane), Point of symmetry (point of inversions), Internal symmetry elements of a crystal: screw axis, glide plane, Elementary idea of notation used to define symmetry elements of the crystal.

**Unit II:** **Crystal Structure**

Interpretation of powder photographs using graphical method and analytical method, Moving film method of x-ray crystallography, Crystal structure factor and intensity of diffraction maxima, Extinction due to lattice centering, Neutron scattering and their applications, Debye Waller factor, Mossbauer effect

**Unit III:** **Lattice dynamics & electronic properties**

Anharmonicity, thermal expansion and thermal conductivity, Interaction of electrons & phonons with photons (direct & indirect transitions), Optical properties of metals. Electron in periodic lattice, band theory of solids (metal, semiconductor & insulator). Effective mass, Tight binding approximation, introductory idea: magneto resistance (GMR&CMR) & Q Hall effect (Integer & Fractional).

**Unit IV:** **Superconductivity**

Phenomenological, Semi phenomenological and microscopic theories of super conductors, Penetration depth, coherence length, Josephson effects (DC, AC and microscopic interference), Elementary idea of high temperature superconductors.

**Books recommended:**

C.S. Kittle : Introduction to solid state Physics
C.S. Kittle : Quantum theory of solids
Verma & Srivastava : Crystallography for solid state Physics
S. O. Pillai : Solid State Physics
Ashcroft & Mermin: Solid State Physics
Ziman : Solid State Physics
Ziman : Solid State Physics

## M.Sc. Physics Syllabus (Semester System 2017 -18 Onwards)
## Kumaun University Nainital
## IVth Semester

**Paper - 16 Special Paper II (Any one of the followings)**

**(a) Advanced Electronics**

**(b) High Energy Physics**

**(c) Spectroscopy**

**(d) Astrophysics**

**(e) Advanced Condensed Matter Physics**

**Practical**

# Syllabus for M. Sc. Physics IV Semester
## Paper 16(a)
### Special Paper –II Part
## (PHY-4946) Advanced Electronics – II 75 Marks

**Unit I: (a) Integrated Circuit Technology**

Classification of IC's, Fabrication of IC's & components, Basic monolithic integrated circuit technology, processes used in monolithic technology, active & passive components, metal semiconductor contact, thick & thin film IC's, hybrid IC's, charge coupled devices (CCD), advantages & limitations of integrated circuits

**(b) Analog computation**

Solution of ordinary linear differential equations with constant coefficients, Operation modes of analog computers, repetitive operation of computers, Time scaling, amplitude scaling, Generation of functions, Simulation of time varying systems.

**Unit-II: Combinational Circuits**

Boolean algebra, Canonical forms of Boolean functions, Simplification of Boolean functions (K-map method, Tabulation method), Don't care conditions, Digital logic families; Adders & Subtractors, Magnitude comparator, Code converters; Parallel adders, Encoders, Decoders, Multiplexers, Demultiplexers, Parity bit generator and checker; Read only memory (PROM, EPROM), P. L. A., Digital to Analog and Analog to Digital converters.

**Unit-III: Sequential Circuits**

Sequential Logic- Memory element; RS, JK, JKMS, D type, T type and Edge triggered Flip flop; Registers; Shift register; Counters-Asynchronous and Synchronous; The memory unit; Semiconductor Random Access Memory. Inter-register transfer; Arithmetic; Logic and Shift Micro-operation; Fixed point and Floating point data.

**Unit IV: Memory and optoelectronic devices**

Bulk and thin films, Photoconductive devices (LDR), Memory devices, Static and dynamic random access memories SRAM and DRAM, CMOS and NMOS, non-volatile-NMOS, Magnetic, Optical and ferromagnetic memories, Charge coupled devices (CCD), LCDS.

**Books Recommended:**

Digital Technology : Virendra Kumar (New Age International (P) Ltd.)
Digital Logic and Computer Design : M. Morris Mano (PHI)

Rajaraman: - Introduction to digital Computer Design (Prentice Hall)
Schilling and Belov: Electronics circuits Discrete and Integrated Sloan:
Computer Hardware and Organization (Galgotia Publication)
Vishwanathan Mehta: - Electronics for Scientists and Engineers Roychaudhary
and Jain: Operational amplifier and Linear Integrated Circuits
Malmsradl, Enke and Toren:- Electronics for Scientists Bodhkar:- Electronics for Scientists
(Khanna Publishers)

# Syllabus for M. Sc. Physics IV Semester
# Paper- 16(b)
### Special Paper –II Part
# (PHY-4947) High Energy Physics –II 75 Marks

**Unit I:** **Gauge Field Theories**

Concept of gauge fields and gauge connections, Principle of gauge invariance, Global and local Abelian gauge invariance , U (1) gauge invariance of QED, The Yang- Mills gauge field, Non-Abelian gauge field theory (SU(2) case), Concept of spontaneous symmetry breaking and Goldstone Bosons, Higgs Mechanism and mass generation of gauge fields.

**Unit II:** **Lie Group and Unitary Symmetries,**

Symmetries, Groups and Conservation Laws, Lie groups, General concept of about Generators of Lie groups Lie group, Its application for finding put Lie algebra of different dimension and parameter group, SU (3) shift operators, Concept of I, U and V spins, Young Tableaux and its application for Unitary Symmetries.

**Unit III:** **Weak and Electromagnetic interactions**

Classification of weak interaction in terms of Leptonic, Semi-leptonic and Non- Leptonic weak Decays, Current-Current Interaction and VA theory, Intermediate Vector Boson (IVB), Vector Current (CVC) Hypothesis, Two Component Theory of Neutrino, Basics of electro weak unification and W-Z bosons.

**Unit IV:** **Strong Interactions**

Paradoxes of Naive Quark Model, Need of color quantum Number for Quarks, Color SU(3) and Gluons, Quantum Chromodynamics, Pion-Nucleon Scattering, Spin Classification of Hadrons and Regge Trajectories, Asymptotic freedom, Elementary idea of standard model and its limitations.

**Books Recommended**

DB Lichtenberg: Unitary Symmetry and Elementary Particles
FE Close: Quarks and Patrons
I.J. Aitchison and A.J. Hey : Gauge theories in Particle Physics
F. Haltzin & A.D. Martin : Quarks and Leptons
D.H. Perkins: Introduction of High Energy Physics
T.P.Cheng and G.LF Li : Gauge Field Theory
ED Commins : Weak Interactions
D.C. Cheng and O Neil : Elementary Particle Physics
B.S.Rajput : Advanced Quantum mechanics
K. Moriyasu: An elementary Primer for gauge theory
D.C. Joshi: Introduction to Quantum Electrodynamics and Particle Physics
D.J.Griffith: Introduction to Elementary Particles

# Syllabus for M. Sc. Physics IV Semester
# Paper 16(c)
### Special Paper –II Part
# (PHY-4948) Spectroscopy –II 75 Marks

**Unit I:** **Lasers**

Einstein's quantum theory of radiation, Life time, Possibility of amplification, Theory of some simple optical processes, Kinetics of optical absorption, Line broadening mechanism, Stimulated emission, laser pumping, three and four level scheme, Threshold condition, laser pumping power, different types of lasers, gas lasers: He-Ne, $N_2$ and $CO_2$ , Dye lasers, Solid state lasers, Nd-YAG, Semiconductor lasers, Basic application of laser spectroscopy, Laser cooling and trapping of atoms etc.

**Unit II:** **Dynamics of Laser processes and Advances in laser physics:**

Production of giant pulse, Q-Switching by different types of shutters, Giant pulse dynamics, Laser amplifiers, mode locking, Mode pulling, ultra-short pulse, Hole burning, Holography, Laser applications e.g. isotope separation method, Laser produced plasma, Synthesis of nanoparticles, Laser cooling and trapping of atoms etc.

**Unit III:** **Non-Linear Optics**

Harmonic generation, Phase matching, Second harmonic generation, Third harmonic generation, Optical mixing, Parametric generation of light, Self focusing of light.

**Unit IV:** **Multi-Photon Processes**

Multi quantum photoelectric effect, Two photon processes, Frequency up-conversion, Stimulated Raman effect, Coherent stokes & anti-stokes Raman scattering, Photo acoustic spectroscopy.

**Books recommended:**


Laud B.B :Laser and non linear optics, wiley eastern
Thyagrajan & ghatak :Laser and applications.
Hollas J.M. :Laser and non-linear optics.
Svelto :Lasers.
Demtroder :Laser Spectroscopy


# Syllabus for M. Sc. Physics IV Semester
# Paper 16(d)
### Special Paper –II Part
# (PHY-4949) Astrophysics –II 75 Marks

**Unit I : Observing the Universe**

Celestial sphere, Brief idea of constellations & Solar system, Study of planets and their satellites, Earth-Moon system, tidal forces, asteroids, meteors, comets and their origin, composition and dynamical evolution, extra solar planets and their detection. Right Ascension, Declination, Greenwich Sideral time, Local Sideral time, Hour angle , Different type of detectors: photographic plate, Photomultiplier tube, CCD, Astronomical telescopes, Basic parameters of the star: Mass, radius, Distance, Luminosity and temperature, Magnitude systems and colour indices,

**Unit II : Hertzsprung - Russel Diagram and Study of Sun**

Hertzsprung-Russel diagram (H-R Diagram), classification of stellar spectra, classification of Luminosity class, Sun as a typical star, Solar inner and outer atmosphere, Quiet and Active Sun, Sunspots and their formation, Solar flares, Solar filaments/prominences, Coronal mass ejections (CMEs), Solar wind, Different type of solar eruptions models, Coronal heating, Origin of solar cycle, solar geomagnetic storm.

**Unit III: Star Clusters and their properties**

Star clusters : open, globular and stellar associations, stellar population, population I and population II type objects, inter-stellar extinction, Reddening determination from colour –colour diagram, age and distance determinations of star clusters, Luminosity function, Mass function, Mass segregation, dynamical evolution in clusters, Mass-Luminosity relation

**Unit IV: Stellar Evolution**

Birth of stars, protostar, nebula, Hyashi tracks, Zero age main sequence, (ZAMS) main sequence life time, energy generation in stars – gravitational contraction, pp chain, CN cycle and triple alpha process, stellar life cycles-Premain sequence, main sequence, giants, white dwarf etc., Chandrashekhar mass limit, Low medium mass stars and high mass stars, Death of high mass stars, supernova remnants.

**Books Recommended**

Abhyankar K.D. : Astrophysics, Galaxies and Stars
Baidyanth Basu : An Introduction to Astrophysics
Motz : Astrophysics

# Syllabus for M. Sc. Physics IV Semester
# Paper 16(e)
### Special Paper –II Part
# (PHY-4950) Advanced Condensed Matter Physics –II 75 Marks

**Unit I: Advance methods of crystallography & surface topography**

Accurate determination of lattice parameter, least square method, application of powder methods (including in designing advanced method of crystallography), observations of imperfection in crystal using radiation (X-ray), Electron microscopy (scanning & tunneling): elementary idea of transmission electron microscopy, scanning electron microscopy, Atomic force microscopy.

**Unit II: Disordered systems**

Point defects: Shallow impurity states in semi-conductors, Vacancies, Interstitials and colour centers of an ionic crystal, Disorder in the condensed matter systems: substitutional disorder, Positional disorder and topological disorders, short range & long range order.

**Unit III: Exotic Solids**

Structure and symmetries of liquids, amorphous solids, glass, liquid crystals, Fibonacy sequence, elementary idea of an a periodic solids and quasi crystals, definition and properties of nano structured materials, quantum size effect, special carbon solids: fullerenes and nano tubules.

**Unit IV: Thin film & surface states**

Definition & properties of thin film, Difference in behavior of thin film form bulk, electrical conductivity of thin film, Boltzmann transport equation for a thin film for only diffused scattering case, Elementary idea regarding surface states, metallic, surface & surface reconstruction.

**Books recommended**

C.S. Kittle : Introduction to solid state Physics
C.S. Kittle : Quantum theory of solids
Verma & Srivastava : Crystallography for solid state Physics
Poole : Nanotechnology
Steinhardt & Ostulond : The Physics of Quasi crystal

Singh Shri : Introduction to Liquid crystals
S. O. Pillai: Solid State Physics
Ashcroft & Mermin: Solid State Physics
Ziman: Solid State Physics
K L Chopra: Thin Film
Madelung: Solid State Physics

## M.Sc. Physics Syllabus (Semester System 2017 -18 Onwards)
## Kumaun University Nainital
## IV$^{th}$ Semester

# List of Experiments:Advanced Electronics

1. Study of regulated power supply (723).
2. Study of operational amplifier (741).
3. Study of Timer (555).
4. A to D and D to A converter
5. 1 of 16 Decoder/Encoder
6. Study of Multiplexer/Demultiplexer
7. Study of Logic gates (Different types)
8. Study of Comparator and Decoder
9. Study of amplitude and frequency modulations and demodulations.
10. Study of different flip- flop circuits (RS, JK, Dk type, T-type, Master slave).
11. Study of Digital combinational and sequential circuits
12. Study of Microprocessor (8085)
13. Study of SCR, DIAC, TRIAC
14. Study of IC- Based Power supply
15. Microwave experiment.
16. Shift Registers
17. Fiber Optics communication

**M.Sc. Physics Syllabus (Semester System 2017 -18 Onwards)**
**Kumaun University Nainital**
**IV$^{th}$ Semester**

# List of Experiments: High Energy Physics

1. Characteristic curve of a GM Detector and verification of inverse square law .
2. Characteristic curve of a GM Detector and Absorption coefficient of a using aluminum GM Detector.
3. Energy spectrum of gamma rays using gamma ray spectrometer.
4. Absorption coefficient of aluminum using gama-ray spectrometer.
5. Characteristics of Scintillation Detector.
6. Study of gama-gama unperturbed angular correlations.
7. Study of particle tracks using a Nuclear Emulsion Detector.
8. Classification of tracks in interaction with Nuclear Emulsion and determination of excitation energy.

**M.Sc. Physics Syllabus (Semester System 2017 -18 Onwards)**
**Kumaun University Nainital**
**IV$^{th}$ Semester**

# List of Experiments: Astrophysics

1. Study of Hubble's law (from given data)
2. Study of constant density neutron star
3. Study of the static parameters of a Neutron Star model with inverse square density distribution
4. Study of star cluster from a given data
5. Study of Extinction coefficients
6. Study of variability of stars
7. Verification of Limb darking using the Solar data
8. Verification of Solar cyclic using the given data

# M.Sc. Physics Syllabus (Semester System 2017 -18 Onwards)
# Kumaun University Nainital
# IV$^{th}$ Semester

## List of Experiments: Spectroscopy

1. Study of the vibrational levels of Iodine.
2. Measurement of the fluorescence spectra of Uranyl Nitrate Hexahydrate.
3. Determination of the intrinsic life time for a dye molecule.
4. Determination of change in dipole moment in excited state using Solvatochromic shift method.
5. Measurement of non radiative decay rate for a known sample.
6. Determination of the quantum yield of known samples using steady state spectroscopy.

**M.Sc. Physics Syllabus (Semester System 2017 -18 Onwards)**
**Kumaun University Nainital**
**IV$^{th}$ Semester**

# List of Experiments: Advanced Condensed Matter Physics

1. Determination of elastic constant of crystals by optical methods
2. Study of fluorescence spectra of a given compound
3. Study of colour centers
4. Determination of lattice parameters using powder method.
5. Determination of hall coefficient using Hall effect
6. Determination of Energy gap of a semiconductor by four probe method
7. Study of ratio of energies of the X-ray in different orders of diffraction.
8. Determine the interplaner crystal spacing of the NaCl crystal.
9. Investigation of Bragg reflection at an NaCl monocrystal and confirm Bragg's law of reflection.
10. Simultaneous first and higher order diffraction on a crystal.