INDIRA GANDHI UNIVERSITY, MEERPUR

M.Sc. Physics (Two year Course)

Semester – 4th

Choice Based Credit System

Scheme of Examination

Session 2020-21

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M.Sc. 4th Semester

Paper Code	Type of Course	Nomenclature	Contact Hours (L+T+P)	Credit	Examination Scheme			Total
					Theory	Internal Assessment	Practical	
PHY-401	C.C	Nuclear & Particle Physics	4+0+0=04	04	80	20		100
PHY-402	C.C	Physics of Nano-Materials	4+0+0=04	04	80	20		100
PHY-403 PHY-404	D.C.E.C	Solid State Physics-1 Or Electronics-1	4+0+0=04	04	80	20		100
PHY-405 PHY-406	D.C.E.C	Computational Methods& Programming-1 Or Atomic & Molecular Physics-1	4+0+0=04	04	80	20		100
PHY-408	C.C	Practical General	0+0+12=12	06			100	100
PHY-409 PHY-410	D.C.E.C	Practical Solid State Physics-1 Or Electronics-1	0+0+06=06	03			50	50
PHY-411 PHY-412	D.C.E.C	Practical Computational Methods& Programming-1 Or Atomic & Molecular Physics-1	0+0+06=06	03			50	50
PHY-413		Seminar	01	01				25
PHY-414		Self Study paper	01	01				25

CC = Core Course DCEC = Discipline Centric Elective Course FEC = Foundation Elective Course
Duration: 02 Years Total Credits = 129 Total Marks = 2850

Note:

- Maximum marks of M.Sc. 4th semester will be 650
- Each theory paper will include 20% marks as internal assessment as per University rules.
- Total Credits = 30

- No elective paper shall be offered unless the number of students, opting for particular paper is equal to ten or more. Elective papers will be offered according to the availability of the teachers in the department.

- Break up of internal assessment marks:

Assessment Exam. Paper	:	10 marks
Attendance	:	5 marks
Assignment/term paper & presentation	:	5 marks
Total	:	20 marks

- The distribution of percentage marks in practical papers will be as follows:

Experiment	60%
Viva	20%
Seminar	10%
Laboratory Report	10%
Total	100%

General Instructions

1. **Seminar/ Journal Club**

Max.Marks-25

Every candidate will have to deliver a seminar of 30 minutes duration on a topic (not from the syllabus) which will be chosen by him / her in consultation with the teacher of the department. The seminar will be delivered before the students and teachers of the department. A three member committee (one coordinator and two teachers of the department of different branches) duly approved by the departmental council will be constituted to evaluate the seminar. The following factors will be taken into consideration while evaluating the candidate.

Distribution of marks will be as follows:

1. Presentation 10 marks
2. Depth of the subject matter 10 marks
3. Answers to the questions 05 marks

2. **Self Study Paper**

Max.Marks-25

Objective: This course intends to create habits of reading books and to develop writing skills in a manner of creativity and originality. The students are to emphasis his/her own ideas/words which he/she has learnt from different books, journals and newspapers and deliberate the same by adopting different ways of communication techniques and adopting time scheduling techniques in their respective fields. This course aims: - To motivate the students for innovative, research and analytical work - To inculcate the habit of self study and comprehension - To infuse the sense of historical back ground of the problems - To assess intensity of originality and creativity of the students. Students are guided to select topic of their own interest in the given area in consultation with their teachers/Incharge/Resource Person.

Instructions for Students

1. Choose the topic of your interest in the given areas and if necessary, seek the help of your teacher.
2. Select a suitable title for your paper.
3. You are expected to be creative and original in your approach.
4. Submit your paper in two typed copies of A4 size 5-6 pages (both sides in 1.5 line spaces in Times New Roman Font size 12).
5. Organize your paper in three broad steps: (a) Introductions (b) Main Body (c) Conclusion
6. Use headings and sub-headings
7. Use graphics wherever necessary
8. Give a list of books/references cited/used
9. The external examiner will evaluate the self-study paper in two ways i.e. Evaluation 15 Marks and Viva-Voce 10 marks.

Distribution of Marks

1. The evaluation is divided into different segment as under: 15 Marks
    i. Selection of Topic - 3 Marks
    ii. Logical Organization of subject matter - 5 Marks
    iii. Conclusions - 5 Marks
    iv. References - 2 Marks
2. Viva-Voce: - 10 Marks

The external examiner will hold Viva-Voce based on contents of the student's Self Study Paper focusing upon the description by the Candidate.

M.Sc Physics Semester IV
Nuclear and Particle Physics (PHY-401)

Theory Marks:80
Internal Assessment Marks:20 Time : 3 Hours

Course Objectives:

1. To achieve the knowledge about the nucleus and nuclear forces.
2. To know the various type of Nuclear Models and how these are help to find out spin, parity, magnetic moment of different nuclei.
3. To know about the Radioactivity and different types of nuclear decays and reactions.
4. To achieve the basic knowledge about elementary particles, type of forces exist in nature and classification of elementary particles on basis of spin, mass, charge and interaction.

Unit I Two nucleon problem and nuclear forces:
The deuteron : binding energy, dipole moment quadrupole moment and the evidence of non-central (Tensor) force, spin dependence of nuclear force. Nucleon-nucleon scattering ; s-wave effective range theory, charge independence and charge symmetry of nuclear forces, iso-spin formalism.
Unit II Nuclear Models :
Liquid drop model ,stability of nuclei, fission ; evidence of shell structure, the shell model spin parity and magnetic moment in extreme single particle model, evidence of collective excitations, collective vibration of a spherical liquid drop.
Unit III Nuclear decays and nuclear reactions :
Alpha, Beta and Gamma decays, Selections rules, Fermi's theory of beta decay, selection rules, comparative half lines, Kurie plot Fermi and Gamow -Teller Transitions; parity non-conservation in beta decay. Reaction cross section, compound nuclear reactions and direct reactions, the optical model, Breit-Winger resonance formula for l=0, disintegration constant of radio-active decay half life time.
Unit IV Elementary Particle :
Basic interactions in nature : Gravitational Electromagnetic, weak and strong, classification of elementary particles, Leptons, Hadrons, Mesons, Baryons. Conservation Laws for Elementary Particles.Baryon, Lepton and Muon number, Strangeness and Hypercharge, Gelleman - Nishijima formula. Quark model, SU (2) and SU (3) Symmetries Parities of subatomic particles, charge conjugation, Time reversal.

Course Outcomes:

1. Students would be able to realize the nature of nuclear force.
2. Students would be able to understand the structure of nucleus and would be able to find out spin, parity, magnetic moments etc. of different nuclei.
3. Students would be able to understand different nuclear decays and reactions.
4. Students would gain a basic knowledge about Elementary Particle and interactions.

Note : The syllabus is divided into four units. **Nine** questions will be set in all. Question No.1 will be compulsory having four to eight parts covering the whole syllabus. In addition there will be two questions from each unit and the student is to answer one question from each unit.

Text and Reference Books :

A.Bohr and B.R. Mottelson, Nuclear Structure, Vol. 1(1969) and Vol. 2 (1975) , Benjamin, Reading A, 1975

Kenneth S. Kiane, Introductory Nuclear Physics, Wiley, New York, 1988 Ghoshal,S.N Atomic and Nuclear Physics Vol. 2.

P.H. Perkins, Introduction to High Energy Physics, Addison-Wesley, London, 1982

A Preston and A Bhaduri : Nuclear Physics

H. Frauenfelder and E. Henley : Subatomic Physics

M.ScPhysics Semester IV
Physics of Nano-materials (PHY-402)

Theory Marks:80
Internal Assessment Marks:20 Time : 3 Hours

Course Objectives:

1. To understand the influence of dimensionality of the object at nanoscale on their properties
2. To understand Quantum size effect on energy and density of states with size of crystal
3. To learn techniques for characterization nanostructured materials
4. To learn size and shape controlled synthesis of Nano materials and their future application

Unit I
Free electron theory (qualitative idea) and its features, Idea of band structure, Metals, insulators and semiconductors, Density of states in bands, Variation of density of states with energy, Variation of density of states and band gap with size of crystal.
Unit II
Electron confinement in infinitely deep square well, confinement in two and one dimensional well, Idea of quantum well structure, Quantum dots, Quantum wires.
Unit III
Determination of particle size, Increase in width of XRD peaks of nanoparticles, Shift in photoluminescence peaks, Variations in Raman spectra of nanomaterials.
Unit IV
Different methods of preparation of nanomaterials, Bottom up : Cluster beam evaporation, Ion beam deposition, Chemical bath deposition with capping techniques and Top down : Ball Milling.

Course outcomes:

Students will achieve the ability to:
1.explain the effects of quantum confinement on the electronic structure and corresponding physical and chemical properties of materials at nanoscale.
2.choose appropriate synthesis technique to synthesize quantum nanostructures of desired size, shape and surface properties.
3.correlate properties of nanostructures with their size, shape and surface characteristics.

Note : The syllabus is divided into four units. **Nine** questions will be set in all. Question No.1 will be compulsory having four to eight parts covering the whole syllabus. In addition there will be two questions from each unit and the student is to answer one question from each unit.

Text and Reference Books :
Nanotechnology Molecularly designed matrials by Gan -Moog Chow, Kenneth E. Gonsalves, American Chemical Society
Quantum dot heterostructures by D. Bimerg, M. Grundmann and N.N. Ledenstov, John Wiley & Sons, 1988.
Nano technology : :molecular speculations on global abundance by B.C. Crandall, MIT Press 1996.
Physics of low dimensional semiconductors by John H. Davies, Cambridge Univ. Press 1997.

Physics of Semiconductors nano structures by K.P. Jain, Narosa 1997.
Nano fabrication and bio system : Integrating materials science engineering science and biology by Harvey C. Hoch, Harold G. Craighead and Lynn Jelinskii, Cambridge Univ. Press 1996.
Nano particles and nano structured films ; Preparation characterization and applications Ed. J.H. Fendler, John Wiley & Sons 1998.

M.Sc Physics Semester IV
Solid State Physics –II (PHY-403)

Theory Marks:80
Internal Assessment Marks:20 Time : 3 Hours

Course Objectives:

1. To understand the symmetry elements of crystals, concept of point groups and space groups, crystal structure determination methods.
2. To understand the term X-Ray Crystallography.
3. To achieve the knowledge about the liquid crystal, Aperiodic solids and Quacasicrystal, Penrose tiling
4. To learn about the special carbon solids and its application in various field of science.
5. To learn about the nano-structured material, its synthesis techniques and its application.

Unit1: Crystal Physics
External symmetry elements of crystals. Concepts of point groups. Influence of symmetry on Physical properties : Electrical conductivity. Space groups, derivation of equivalent point position (with examples from triclinic and monoclinic systems), experimental determination of space group. Principle of powder diffraction method, interpretation of powder photographs.
Unit II : X-Ray Crystallography
analytical indexing: Ito's method. Accurate determination of lattice parameters - least-square method.Applications of powder method. Oscillation and Buerger's precession methods.; Determination of relative structure amplitudes from measured intensities (Lorentz and polarization factors), Fourier representation of electron density. The phase problem, Patterson function.
Unit III : Exotic Solids
Structure and symmetries of liquids, liquid crystals and amorphous solids.Aperiodic solids and quasicrystals; Fibonaccy sequence, Penrose lattices and their extension to 3-dimensions. Special carbon solids; fullerenes and tubules ; formation and characterization of fullerenes and tubules. Single wall and multi-wall carbon tubules.Electronic properties of tubules. Carbon nanotubule based electronic based electronic devices.
Unit IV : Nano Structural Materials
Definition and properties of nanostructured materials.Methods of synthesis of nanostructured materials.Special experimeental techniques for characterization nanostructured materials.Quantum size effect and its applications.

Course outcomes:

1. Students would have knowledge about the influence of symmetry on physical properties of crystal.
2. Students would understand the meaning crystallography and application of powder method.
3. Students would have knowledge about the carbon special solids: fullerene and carbon nanotubes and carbon nanotubule based electronics devices.
4. Students would have knowledge about nano structured material and quantum size effect and its application.

Note : The syllabus is divided into four units. **Nine** questions will be set in all. Question No.1 will be compulsory having four to eight parts covering the whole syllabus. In addition there will be two questions from each unit and the student is to answer one question from each unit.

Text and Reference Books :

Azaroff : X-rayCrystallography Weertman&Weertman
: Elementary Dislocation Theory
Verma&Srivastava : Crystallography for Solid State
Physics Kittel : Solid State Physics
Azaroff&Buerger : The Powder Method
Buerger: Crystal Structure Analysis
M.Ali Omar: Elementary Solid State Physics
The Physics of Quasicrystals, Eds. Steinhardt and Ostulond
Handbook of Nanostructured Materials and Nanotechnology (Vol. 1 to 4). Ed. Hari Singh Nalwa

M.Sc Physics Semester IV

Electronics – II (PHY-404)

Theory Marks:80

Internal Assessment Marks:20 Time : 3 Hours

Course Objective:

1. The aim of the course is to provide students with a thorough knowledge of Semiconductor devices
2. It also aims to develop an understanding of communication system and signals.
3. To learn designing of simple circuits like amplifiers (inverting and non inverting), comparators, adders, integrator and differentiator using op-amps will be discussed.
4. To understand circuit analysis and implementation of operational amplifier for various applications like comparator, A/D & D/A convertor, oscillators etc.

Unit I

External Photoelectric Effect detector: Vacuum photodiode, photo-multipliers, microchannels, Internal Photoelectric Effect detectors: pn junction photodiode, solar cell (open circuit voltage, short circuit current, fill factor), pin photodiode, avalanche photodiode, phototransistor, Light emitting diode.

Unit II

Fundamentals of modulation, Frequency spectra in AM modulation, power in AM modulated class C amplifier, Efficiency modulation, linear demodulation of AM waves, frequency conversion, SSB system, Balanced modulation, filtering the signal for SSB, phase shift method, product detector, Pulse modulation: PAM, PTM, PWM, PPM, PCM(in brief)

Unit III

Differential amplifier, CMRR, circuit configuration, emitter coupled supplied with constant current, transfer characteristics, block diagram of Op. Amp. Off-set currents and voltages, PSRR, Slew rate, universal balancing techniques, Inverting and non-inverting amplifier, basic applications- summing, scaling, current to voltage and voltage to current signal conversion, differential dc amplifier, voltage follower, bridge amplifier, AC-coupled amplifier.

Unit IV

Integration, differentiation, analog computation, Butterworth active filter circuits, logarithmic amplifier, antilogarithmic amplifier, sample and hold circuits, digital to analog conversion – ladder and weighted resistor types, analog to digital conversion- counter type, AC/DC converters, comparators, regenerative comparator (Schemitt trigger), Square wave generator, pulse generator, triangle wave generator.

Course Outcome:

Students who have completed this course should:

1. Gain knowledge and understanding of communication systems.
2. Have basic knowledge of frequency modulation and radar system.
3. Have knowledge of pulse communication and its applications Comprehend broadband communications.

Note : The syllabus is divided into four units. **Nine** questions will be set in all. Question No.1 will be compulsory having four to eight parts covering the whole syllabus. In addition there will be two questions from each unit and the student is to answer one question from each unit.

Text and Reference books:

Integrated Electronics by J. Millman and C.C.Halkias (Tata-McGraw Hill) Fundamental of Electronics by J.D.Ryder (Prentice Hall

Publication).
Electronics communication Systems by George Kennedy and Bernard George (McGraw Hill).
Linear Integrated Circuits by D.RoyChoudhury and Shail Jain (Wiley Eastern Ltd)
Solid State Electronic Devices by Ben G. Streetman ((Parentice Hall of India)
Semiconductor Optoelectronic devices by Pallab Bhattacharya (Parentice Hall of India)

M.Sc Physics Semester IV

Computational Methods & Programming – II (PHY-405)

Theory Marks:80

Internal Assessment Marks:20 Time : 3 Hours

Course Objectives:

1. To get knowledge about the Conceptual frame work of Computer languages.
2. To solve the various statements in computer languages and oriented concepts.
3. To understand the introduction of C++, JAVA languages.

Unit 1

Introduction to UNIX/LINUX, Conceptual frame work of Computer languages, Introduction to C/C++ : constants, variables, data types, declaration of variables, user defined declaration, operators, heirarchy of arithmatic operators, expressions and statements; Control statements: if, switch, conditional operator, goto, if ---- else.

Unit II

Decision making and looping statements : while, do --- while, for; built in functions and programme structure, strings; input and output statement; pointers and arrays; subprograms; function overloading recursion; file access.

Unit III

Object oriented concepts; classes, objects, incapsulation and inheritence, reuse and extension of classes, inheritance and polymorphism; virtual functions and virtual classes; friend functions and friend classes. Case studies and applications using some object oriented programming languages.

Unit IV

Introduction to web enabling technologies and languages: Introduction to HTML, HTML Page Formatting Basics, Tables and Frames, Web Page Forms, Introduction to JAVA, Basic difference between C++ and JAVA.

Course Outcomes:

1. Students would be able to understand framework of computer languages
2. Students would be able to solve numerically various physical problems
3. Students would gain the necessary basic knowledge of web languages C++, JAVA

Note : The syllabus is divided into four units. **Nine** questions will be set in all. Question No.1 will be compulsory having four to eight parts covering the whole syllabus. In addition there will be two questions from each unit and the student is to answer one question from each unit.

Text and Reference Books :

Timothy Bold : An Introduction to Object Oriented Programming 2nd Edition, Addison - Wesley 1997.
Balgurisamy E: Object Oriented Programming with C ++ ,Tata McGraw Hill, 2000. Chandra B: Object Oriented programming using C+ +, Narosa, New Delhi, 2002. Rajaram R: Object Oriented programming and C+ +, New Age, New Delhi, 1999. Mcgrath Mike: HTML 4, Dreamtech Press, New Delhi, 2001.
Merger David: HTML, Tata McGraw Hill, New Delhi, 2002.
Kamthane Ashok N.: Object Oriented Programming with ANSI & TURBO C++, Pearson

M.Sc Physics Semester IV
Atomic and Molecular Physics – II (PHY-406)

Theory Marks:80
Internal Assessment Marks:20 Time : 3 Hours

Course objectives:

1. To get broad coverage of NMR.
2. T learn Mossbauer spectroscopy and related terms & phenomena.
3. To understand Description, relaxation mechanisms, features and applications of ESR.
4. To understand Laser and mechanism involved in lasing action.
5. To learn about types of laser and applications in detail.

Unit 1
NMR
NMR, The principle of NMR, NMR spectrometer, Types of NMR, Types of nuclei viewed from the stand point of NMR, High Resolution and Broad line NMR, Relaxation mechanisms, chemical shift; spin-spin coupling. Applications of NMR spectroscopy.
Mossbauer Spectroscopy
Mossbauer Spectrometer, Isomer nuclear transition, Resonance fluorescence, Mossbauer effect, Mossbauer nuclei, Isomer shift, quadrupole splitting, Magnetic hyperfine structure. Applications of Mossbauer spectroscopy.
Unit II
ESR spectrometer, substances which can be studied by ESR, Resonance condition. Description of ESR by Precession, Relaxation mechanisms, Features of ESR spectra (a) the g factor (b) Fine structure (c) hyperfine structure (d) ligand hyperfine structure. Applications of ESR
Unit III
Spontaneous and stimulated emission, Absorption, Einstein coefficients. The laser idea, properties of laser beams, Rate equations, methods of obtaining population inversions, laser resonator;
Unit IV
Nd: YAG Laser, CO2 laser, Nitrogen laser, Dye laser, Laser Applications: Holography material processing fusion reaction, laser isotope separation.

Course outcomes:

Successful completion of course would enable the students

1. To explain principle, types, broad line, relaxation mechanism, chemical shift and spin-spin coupling in NMR.
2. To analyze resonance fluorescence, isomer nuclear transition, Mossbauer effect, quadrupole splitting, Magnetic hyperfine structure and applications of Mossbauer Spectroscopy.
3. To understand ESR spectrometer, ESR description and features of ESR spectra.
4. To describe emission process, Einstein coefficients, , rate equations and laser resonator.
5. To explain Nd:YAG Laser, CO2 laser, Nitrogen laser, Dye laser and laser

isotope separation.

Note : The syllabus is divided into four units. **Nine** questions will be set in all. Question No.1 will be compulsoryhaving four to eight parts covering the whole syllabus. In addition there will be two questions from each unit and the student is to answer one question from each unit.

Text and Reference Books

Introduction to Atomic and Molecular Spectroscopy by
V.K.Jain Quantum electronics - A. Yariv
Introduction to non-linear laser spectroscopy - M.D. Levenson
Molecular spectra and Molecular structure II and III –Herzberg

M.Sc. Physics Semester IV
Practical General (PHY-407)

Max Marks : 100 Time : 4 Hrs.

Course objectives:

1. To find out e/m value for electron using helical method.
2. To study dispersion relation for the "Monoatomic Lattice" and compare with theoretical aspects.
3. To get familiarized with filters using both active and passive elements.
4. To study and plot the frequency response curve of Push Pull amplifier.
5. To conduct an experiment for finding out the band gap energy for Ge crystal.
6. To perform experiment to study detailed mechanism of fiber optics communication.

Experiments:

1. To determine the e/m for electron by helical method.
2. To determine the band gap energy for the Ge crystal.
3. To determine the magnetic susceptibility of $NiSO_4$, $FeSO_4$, $CoSO_4$ by Gauy's method.
4. To study the low pass, High Pass and Bank Pass filters using active and passive elements.
5. Lattice dynamic Kit
    - Study of the Dispersion relation for the "Monoatomic Lattice" and Comparison with theory.
    - Determination of the Cut-off frequency of the Monoatomic Lattice.
    - Study of the Dispersion relation for the Di-atomic Lattice, Acoustical mode and Energy gap and Comparison with theory.
6. Push Pull amplifier
    - To study the output waveforms of push- pull amplifier in different classes of operation.
    - To plot the frequency response of push – pull amplifier in class AB
7. Dipole-meter: To measure the dielectric constant of non-polar as well as polar liquids.
8. Fiber Optics communication
    - Setting up a Fiber Optic Analog Link.
    - Study of losses in Optical Fiber:
    - Measurement of Propagation Loss.
    - Measurement of Bending Loss.
    - Study of characteristics of Fiber Optic LED & Dtector.
    - Measurement of Numerical Aperture.
    - Study of frequency Modulation & Demodulation using Fiber Optic Link.
    - Setting up a Fiber Optic Digital Link.
    - Study of Modulation & Demodulation of light source by Pulse Width Modulation (PWM)
    - Study of Modulation & Demodulation of Light source by Pulse Position Modulation (PPM)
    - Forming PC to PC Communication Link using Optical Fiber and RS-232 Interface.
    - Setting up a Fiber Optic Voice Link.

Course outcomes:

Students would be able**:**

1. To verify the Lattice dynamic kit
2. To design experimental set up for low and high pass filters.
3. To understand the characteristics of Push Pull amplifier.
4. To acquire a vision for the use of fiber optics in communication.
5. To determine band gap of Ge crystal and magnetic susceptibility of of $NiSO_4$, $FeSO_4$, $CoSO_4$ by Gauy's method.
6. To measure dielectric constant of polar and non-polar liquids.

M.Sc. Physics Semester IV
Practical Solid State Physics – II (PHY-408)

Max Marks : 50 Time : 4 Hrs.

Course Objectives:

1. To conduct experiments, as well as to analyze and interpret.
2. To relate experiments with the theoretical aspects of course.
3. To determine the resistivity, carrier concentration and band gap of a given sample.
4. To determine the magnetic susceptibility of solid sample.
5. To get familiarized with the Hysteresis curve, magneto resistance, curie temperature.

Experiments:

[1] To determine magneto resistance of a Bismuth crystal as a function of magnetic field.

[2] To study hysteresis in the electrical polarization of a TGS crystal and measure the Curie temperature.

[3] To study B-H curve of a given ferrite sample and find energy loss in case of ferrite Core.

[4] To study Hall Effect and to determine Hall coefficient.

[5] To study of dielectric constant as a function of temperature and determine the Curie temperature

[6] To trace the B- H loop (hysteresis) of a ferromagnetic specimen and evaluation of energy loss in the specimen as the function of temperature

[7] Lattice dynamic kit

a) Study of the Dispersion relation for the "Monoatomic Lattice" and Comparison with theory.
b) Determination of the Cut-off frequency of the Monoatomic Lattice.
c) Study of the Dispersion relation for the Di-atomic Lattice, Acoustical mode and Energy gap and Comparison with theory.

[8] To determine the capacitance of a parallel plate Capacitor using Capacitance and permittivity kit

Setting of new experiments will form tutorial for this lab. Course.

Course Outcomes:

1. Students would be able to conduct experiments, as well as to analyze and interpret data.
2. Students would be able to relate experiments with the theoretical aspects of the course.
3. Students would be able to familiarized with advanced spectroscopy.
4. Student would be able to understand the concept of hysteresis loop.
5. Student would be able to find the resistivity , carrier concentration, band gap and susceptibility of a given sample.

M.Sc. Physics Semester IV
Practical Electronics – II (PHY-409)

Max Marks : 50 Time : 4 Hrs.

Course Objectives:

1. To provide practical knowledge and develop skill in digital system & microprocessor.
2. To provide the practical knowledge of microwave test bench & measurement.
3. To provide the knowledge of modulation and demodulation.

Experiments:

[1] To study digital to analog and analog to digital conversion (DAC to ADC) circuit.

[2] To study various applications of Op. Amp.
  a) Op-amp as an integrator
  b) Op-amp as an differentiator

[3] To study the binarymodule -6 and 8 decade counter and shift register.

[4] Study of frequency Multiplication using PLL, Model –A011

[5] Study of Frequency Modulation and Demodulation

[6] Study of pulse Amplitude Modulations & Demodulation model-C019

[7] Transfer characteristics of TTL inverter and TTL trigger inverter with two digital volt meter, model-D518

[8] Study of Module-N Counter using Programmable Counter IC 74190 with input Logics with LED display model D526

Course Outcomes:

1. Students would be able to demonstrate relation between the input and the corresponding digital output of various digital systems.
2. Designing basic building blocks for the ICs for different electronics functions like
   addition, subtraction, code generation, data register, counting etc. would help in realizing complex circuits.
3. Students would be able to appreciate the effect of different types of modulation on the modulating signal.
4. Students would be able for measurement of various digital circuits parameters and comparison of experimental outcomes with theoretical results.

M.Sc. Physics Semester IV
Practical Computational Methods & Programming – II (PHY-410)

Max Marks : 50 Time : 4 Hrs.

Course Objectives:

1 To understand the computer language C++.
2 To acquire the ability to solve the numerical problems by C++ programming.
3 Acquiring Practical Implementation knowledge.

List of C++ programs

1. Write and run a program that reads a six digit integer and prints the sum of its six digits.
2. Write a C++ program to solve a quadratic equation.
3. Write a C++ program that simulates a calculator.
4. Write and run a program to find the sum of the series of 'n2', where 'n' is an integer.
5. Write a C++ program to implement the formula: C(n,k) = n!/k!(n-k)!
6. Write a C++ program to print the Pascal's Triangle.
7. Write a program that counts and prints the number of lines, words, and letter frequencies in its input.
8. Implement a time class. Each objects of this class represents a specific time of day, sorting the hours, minutes and seconds as integers. Include a constructor, access functions, a function advance (int h, int m, int s) to reset the current time of an existing object, and a print () function.
9. Implement a Card class, a composite Hand Class and a composite Deck class for plane poker.
10. Using the concept of function overloading, write a program to calculate the volume of a cube, cylinder and rectangular box

Course Outcomes:

1. Students would develop understanding for computer language programming concepts.
2. Students would learn the practical implementation of programming languages for carrying numerical calculations.
3. Students would be benefited from their enhanced computational skills in context of higher studies in physics/research or business purposes as well.

M.Sc. Physics Semester IV
Atomic & Molecular Physics – II (PHY-411)

Max Marks : 50 Time : 4 Hrs.

Course Objectives:

1. How to use spectrometer and analyze H-atom and ESR spectra.
2. To provide practical knowledge of Michelson interferometer.
3. To design LED and Laser diode and verify I-V & P-I characteristics.
4. To provide practical knowledge of optical bench.
5. To measure numerical aperture of optical fiber and wavelength of He-Ne laser using diffraction grating.

Experiments:

[1] Michelson interferometer.
[2] Analysis of ESR Spectra of transition metals.
[3] Analysis of H-atom spectra in minerals.
[4] LED & Laser Diode Characteristics Apparatus
   a) To Study I-V characteristics of LED and Diode Laser.
   b) To Study P-I characteristics of LED and Diode Laser.
[5] To measure the numerical aperture (NA) of optical fiber
[6] To determine the wavelength of He-Ne Laser light using an engraved scale as a diffraction grating.
[7] Measurement of thickness of thin wire with laser
[8] Determination of Lande's factor of DPPH using Electron - Spin resonance (E.S.R.) Spectrometer.

Setting of new experiments will be tutorial for this lab Course.

Course Outcomes:

Students would be able:

1. To understand and explain the spectra of H-atom in minerals, ESR spectra of transition metals and Lande's factor of DPPH.
2. To describe LED and laser diode characteristics and use them in various applications.
3. To explore Michelson interferometer.
4. To get familiarized with use of optical fiber in communication.
5. To determine wavelength of He-Ne laser using diffraction grating and thickness of thin wire & can correlate experimentally predicted results with standard results.