

# **SAROJINI NAIDU VANITA MAHA VIDYALAYA**

## **DEPARTMENT OF CHEMISTRY**

### **PROGRAMME OUTCOMES**

**Name of the programme: M.Sc.**

- To provide students with the ability to plan and carry out experiments independently and assess the significance of outcomes.
- Specialized Knowledge in the field.
- Career advancement
- Increased earning Potential
- With a masters degree in chemistry job opportunity exist both in the private sector, research institution, pharmacy and other industries.
- Students also develop valuable personal skills and fulfill a crucial prerequisite to Ph.D. study.

### **PROGRAMME SPECIFIC OUTCOMES**

**Name of the Department: Chemistry**

**Name of the programme: M.Sc. Organic Chemistry**

- Organic Chemistry is important for students intending to become chemist and is involved in cross disciplined work with Life Sciences, Biotechnology and Engineering.
- Develop an understanding of chemistry of carbon based compounds.
- Develop an expertise relevant to professional practice of chemist.
- Develop skills in procedures and spectroscopic methods applied in analytically and synthetic task of organic chemistry.
- Experience in some scientific methods employed in organic chemistry.

# COURSE OUTCOMES

## Semester- I

### Paper-1 Inorganic Chemistry

#### Symmetry of molecules:

- Knowledge of symmetry gives us power of prediction. As a result we use symmetry in decision making process of virtually every task we perform.
- Symmetry is very useful in day to day life.
- Able to recognize the symmetry elements and their symmetry operations.

#### Bonding in metal complexes:

- Several metal complexes have many interesting properties in many aspects of human life.
- A huge number of metal complexes are used as catalyst in variety of organic reactions. For example: Polymerization, Hydrogenation.
- Several metal complexes are in clinical use for the treatment of various diseases one such example is cisplatin. It is most successful example for the treatment of cancer

#### Coordination Equilibria:

- The metal ligand interaction in equilibria is used for determination of stability constant values and factors affecting the stability constant values. Example: Nature of ligand, Nature of metal.
- It has wide applications in the use of Spectrophotometry, polarography,  $p^H$  metry for determining the trends in stability constant values.

#### Ligational aspects of diatomic molecules:

- Metal carbonyls are useful in the organic synthesis and as catalyst in homogenous catalysis as hydroformylation.
- In organometallic chemistry metal carbonyls serves as precursors for preparation of other organometallic complexes. These are useful in industrial process for example extraction and purification of Nickel. Metal dinitrogen complexes are very useful in the fixation of dinitrogen.

### Paper-II Organic Chemistry

#### Stereochemistry:

- Stereochemistry is 3D chemistry. It is a field that has often been especially challenging for students because of difficulty in visualizing 3D objects, given 2D representation on paper.
- Physical models and 3D computer models can be of great help and the student is encouraged to use them to understand the stereochemistry. It has significance in Pharmaceutical industries.
- Food and Drug Administration (FDA) requires the drug be produced in enantiomerically pure form, for which understanding the stereochemistry of drug molecule is essential.

### **Reaction Mechanism:**

- A reaction mechanism can be simply defined as the detailed, step- by -step description of the pathway by which reactants are converted into products.
- The study of detailed process of reaction mechanism is important for many reasons; including the help it gives in understanding and controlling chemical reactions.
- There are several reaction mechanisms which describes chemical transformations occurring in the atmosphere.

### **Conformational Analysis:**

- Conformational analysis is an indispensable tool for elucidation of the properties and the behavior of organic molecules.
- It is a comparatively new area of organic chemistry that has been well developed after the theory of organic reactions, bonding in organic compounds and stereochemistry.
- Conformational analysis plays a fundamental role in various research fields of organic chemistry.

### **Natural Products & Heterocyclic Compounds:**

- Natural products have high structural diversity and unique pharmacological or biological activities.
- It covers the field of herbal medicine, organic chemistry and pharmaceutical science. It plays a critical role in the identification of numerous medicines.
- Natural products are the inspiration of approximately half of US FDA approved drugs.
- Heterocyclic compounds are of very much interest in our daily life, they have a wide range of applications. They are predominantly used as pharmaceuticals, as agrochemicals and as veterinary products. Some of the natural products eg: antibiotics such as penicillin, cephalosporin and few alkaloids have heterocyclic moiety.
- In pharmaceutical industries over 75% of the top 200 branded drugs have heterocyclic fragments in their structure.

### **Paper-III Physical chemistry**

### **Thermodynamics:**

- The heat changes during the chemical reaction can be known efficiency (working capacity) of all machines can be known.

### **Chemical kinetics:**

- It relates to many aspects of cosmology, geology, biology, and engineering psychology for reacting implication.
- Refrigerator is real life application for chemical kinetics a refrigerator lowers the temperature of the reactants therefore slowing down the reaction of food rotting because with the lower temperatures the rate of the reaction decreases.
- One more example enzymes several enzymes in a human stomach that allows the activation energy to be lowered therefore this allows the body to digest food in an efficient manner.

### **Electrochemisrty:**

- It deals with the interconversion of electrical energy & chemical energy. The principles of cells are used to make electrical batteries. In science and technology a battery is a device that stores chemical energy and makes it available in an electrical form

### **Quantum chemistry:**

- Quantum theory include quantum chemistry, quantum optics, quantum computing, super conducting magnet, light emitting diode & the laser transistor and semi conductors such as micro processor medical and research imaging.
- Today the most precious clocks in the world atomic clocks are able to use the principle of quantum theory to measure time such super sensitive atomic clocks help with GPS navigation ,telecommunication, surveying.

### **Paper-1V Analytical techniques and spectroscopy-I**

#### **Techniques of chromatography:**

- Chromatography techniques are very useful in the separation of different samples mainly organic samples.
- Chromatography can be used in flavor studies and to detect spoilage in foods such as additive detection, determining nutritional quality, crime sense testing, forensic pathology metabolomics and proteomics and nucleic acid research. These are useful in the quantification methods for the analysis of hydrocarbons in a given mixture

#### **NMR-Spectroscopy-I:**

- NMR spectroscopy is widely used to determine the structure of organic molecules in solution and study of molecular physics, crystals as well as non crystalline materials.
- NMR is also routinely used in advance medical imaging techniques such as magnetic resonance imaging (MRI)

#### **Rotational and Vibrational spectroscopy:**

- Rotational spectroscopy is primarily used in investigation of molecular physics. It is a unique precise tool to determine molecular structure in gas phase.
- Vibrational spectroscopy is used for the identification of functional groups, structural determination of organic compounds, used in pharmaceutical research.

#### **Electronic spectroscopy:**

- Electronic spectroscopy is related to uv-visible radiation. Electronic spectroscopy is widely used to detect environmental samples.
- It is an analytical technique to study electronic structure and its experimental applications include high resolution measurements on the intensity and angular distribution of emitted electrons.

#### **Practicals**

##### **Paper- V: Inorganic Chemistry:**

- Able to estimate the amount of metal ion in given solutions.
- Gain knowledge to synthesize complexes of different shapes.

##### **Paper- VI: Organic Chemistry:**

- To gets expertise in synthesizing various organic compounds independently.
- Gains knowledge of checking the physical constant and purification of organic compounds by recrystalization method.

##### **Paper- VII: Physical Chemistry:**

- Able to perform experiments individually and gain knowledge about principles and techniques involved in various experiments.
- Acquire hands on experience on handling instruments.

## Semester- II

### Paper-1 Inorganic Chemistry

#### Reaction mechanism of transition metal complexes:

- It has an important research application in the metallurgical industry and is of interest in the science of biochemistry, biology, organic, inorganic and bioinorganic chemistry.
- A huge number of metal complexes are used as catalyst in variety of organic reactions example: polymerization, hydrogenation, addition etc.

#### Bonding in metal complexes-II:

- Several metal complexes have many interesting properties in many aspects of human life.
- A huge number of metal complexes are used as catalyst in variety of organic reactions. For example: Polymerization, Hydrogenation. Several metal complexes are in clinical use for the treatment of various diseases one such example is cisplatin. It is most successful example for the treatment of cancer.

#### Metal clusters:

- Metal clusters are very interesting materials with highly active metal sites.
- We have presented the collection of metal clusters having potential for the treatment of different of fetal diseases like cancer, diabetics, alzheimers, cardiovascular disease, hypertension and anemia etc. thus, the metal clusters are now getting prominal share in modern medicines.

#### Biocoordination chemistry:

- Biocoordination chemistry is a field that examines the role of metals in biology.
- Biocoordination chemistry includes the study of both natural phenomena such as the behaviour of metalloprotiens as well as artificially introduced methods including those that are non essential, medicine and toxicology.

### Paper-II Organic Chemistry

#### Reaction Mechanism II:

- To understand the mechanism of nucleophilic aromatic, aliphatic electrophile substitution reaction and effect of different neighboring groups participation on rate of reaction.
- Neighboring group's participation plays a vital role in various research fields of organic chemistry.

### **Percyclic Reaction:**

- Pericyclic chemistry is a promising and creative route to various biologically significant five and six membered oxygen or nitrogen ring system.
- To predict the pericyclic reactions by considering the symmetry molecular orbitals of the system.
- To develop interest and understanding of the theoretical basis for per cyclic reaction and skills for the utilization in organic synthesis.
- Pericyclic reactions are usually rearrangement reactions. It helps to predict stereochemistry and products of the pericyclic reactions.

### **Photochemistry:**

- To predict the base concept for understanding various photochemical reactions.
- To study the synthetic possibility of photochemical reactions to get the target compound.
- To predict synthesis and application of various photochemical reactions.

### **Reactive Intermediates and molecular rearrangement:**

- To study the generation, stability and reactive intermediate in various named reaction.
- To identify the intermediate formed in given reaction and able to predict the mechanism for molecular rearrangement.
- To understand the key concepts in organic chemistry and to prepare students for solving advanced research problems in organic chemistry.

### **Paper-III Physical chemistry**

#### **Thermodynamics-II & Statistical thermodynamics:**

- The heat changes during the chemical reaction can be known efficiency (working capacity) of all machines can be known. Example: all vehicles cars, motorcycles, trucks, ships, aeroplanes, all refrigerators, all types of air and gas compressors.

#### **Photochemistry-I:**

- It has an important application in uv-curable paints, primers and printing inks. Photo stabilizers are primarily used in plastics and man-made fibers. Active ingredients, the investigations of photochemical smog formation and the development of photo degradable plastics.

#### **Quantum chemistry:**

- Quantum theory include quantum chemistry, quantum optics, quantum computing, super conducting magnet, light emitting diode & the laser transistor and semi conductors such as micro processor medical and research imaging.
- Today the most precious clocks in the world atomic clocks are able to use the principle of quantum theory to measure time such super sensitive atomic clocks help with GPS navigation ,telecommunication, surveying.

### **Solid state chemistry:**

- It has an important applications of X-ray diffraction, principles of inorganic crystal structures, crystal chemistry and bonding in solids, phase diagram of 1,2,3 component system.
- It is used in the field of mineralogy, crystallography, ceramics, metallurgy, thermodynamics, material science and electronics with a focus on the synthesis of novel materials.

### **Paper-1V Analytical techniques and spectroscopy-II**

#### **Electro and thermal analytical techniques:**

- Electro analytical methods are a class of techniques in analytical chemistry which study an analyte by measuring the potential and current in electrochemical cell containing the the analyte.
- Electro analytical method has been applied to the characterisation and study of complexing properties of several Cd, Zn and metallothioneins of different mammalian origin.

#### **NMR-Spectroscopy-II:**

- NMR spectroscopy is widely used to determine the structure of organic molecules in solution and study of molecular physics, crystals as well as non crystalline materials.
- NMR is also routinely used in advance medical imaging techniques such as magnetic resonance imaging (MRI)

#### **Mass spectrometry:**

- Mass spectrometry is a powerful analytical tool with many applications in pharmaceutical and biomedical field.
- It is also used as sensitive detector for chromatographic techniques like LC-MS, GC-MS. Specific applications mass spectrometry includes drug testing and discovery, food contamination detection, pesticide residue analysis, protein identification, finger printing and carbon dating.

**Photoelectron & ESR spectroscopy:**

- PES is a technique used for determining the ionization potentials of molecules. The application of X-ray photoelectron spectroscopy (ESCA) to the study of fiber glass surfaces is reported.
- ESR measurements reveal applications in medicine, biology, pharmacy, cosmetology, biotechnology. It is a useful method for the examination of tissues, cells, biopolymers, drugs, cosmetic substances and biomaterials. It is also useful in ophthalmology.

**Practicals****Paper- V: Inorganic Chemistry:**

- Able to estimate the metal ion by using various analytical methods and get knowledge about principles and techniques involved in the experiments.

**Paper- VI: Organic Chemistry:**

- Gain knowledge of handling laboratory equipments.
- Able to identify functional group present in given organic compounds.
- Able to Interpret of the structure of organic compounds by IR, UV, <sup>1</sup>HNMR and Mass spectral data.

**Paper- VII: Physical Chemistry:**

- Gain knowledge in prediction and verification of experimental results by graphical methods.

## Semester-III

### Paper- I Synthetic Reagents, Advanced NMR, Conformational Analysis & ORD

#### Synthetic Reagents:

- Synthetic reagents consist of a broad range of chemicals with many uses in chemical synthesis. They are the key components used for transforming functional groups.
- There are specialized reagents which can be used in trace amounts instead of using large quantities.
- In research, synthetic reagents are used as a catalyst and intermediate in different reactions. Many organic compounds have been synthesized using a variety of synthetic reagents.

#### Advanced NMR- $^{13}\text{C}$ NMR & 2D NMR:

- $^{13}\text{C}$  NMR is an important tool in chemical structure elucidation in organic chemistry. It is a noninvasive and non destructive method i.e. especially used in repetitive in vivo analysis of the sample without harming tissue.
- $^{13}\text{C}$  NMR of biological materials allows for the assessment of the metabolism of carbon, which is so elementary to life on earth.
- 2D NMR is one of the emerging analytical techniques being used more and more in the pharmaceutical and chemical industries.
- In order to fully prepare students for future jobs in industry, it is important to educate students about 2D NMR.

#### Conformational analysis (Cyclic system) & ORD:

- Conformational analysis of medium and large rings is important as they are present in numerous natural products and pharmacologically active products. Thus, not only thoroughly understanding but also an ability to apply conformational analysis to comprehend biological properties of organic compounds and interaction in complex system.
- ORD can be used to find absolute configuration of metal complex and other organic compounds. It also determines optically active substance and stereochemistry of aminoacids and steroids. It is widely used in the structure determination of polypeptides.

### Paper-II Modern Organic Synthesis

#### Asymmetric Synthesis:

- It is one of the important topics of research which completely deals for the development of technology, for production of high value pharmaceuticals and agrochemicals.

### **Synthetic Strategies and Synthetic reaction:**

- It involves the design and control of stereochemistry. It focus on developing key skills in making complicated organic molecules from simple building blocks and transforming one organic molecule to another using the synthetic strategy.
- The concept of retro synthetic analysis is a logic based tool that uses pattern recognition and mechanistic understanding for the design of synthetic pathway. Students will be trained in modern synthetic methodology.

### **Paper-III Bioorganic Chemistry**

- Bioorganic chemistry develops an advanced understanding of the structure and functions of natural organic molecules or compounds.
- Bioorganic chemistry is chemistry at the interface of organic and biological chemistry and involves the design, synthesis and evaluation of substrate, probes and materials for the study of biological systems and principles.
- It involves the study of biological process using chemical methods. Organic chemistry methods are used to synthesize biological molecule and to examine their structure, to investigate biochemical reactions.

### **Paper- IV Green Chemistry & Organic Materials**

#### **Green Chemistry:**

- Green chemistry is the new and rapid emerging branch of chemistry. The beginning of green chemistry is considered as a response to the need to reduce the damage of the environment by manmade materials and the process used to produce them.
- It includes anything from producing waste to even disposing of waste in the correct manner. Success of green chemistry depends on the training and education of new generation of chemist. Students at all levels have to be introduced to the philosophy and practice of green chemistry.

#### **Supramolecular Chemistry:**

- It is important for the development of new pharmaceutical therapies by understanding the interaction at a drug binding site.

#### **Nanochemistry:**

- It is the combination of chemistry and nanoscience. One highly researched application of nanochemistry is medicine eg: Simple skin care product using the technology of nanochemistry is sunscreen.

- Nanochemistry presents a blueprint for the future development of an existing teaching and research programme. Many nanotechnological methods and materials can be functionalized for drug delivery.

## **Practicals**

### **Paper- V: Synthesis of organic molecules and isolation of natural products and TLC:**

- Gets expertise to synthesis various organic compounds.
- Able to handle laboratory equipment like steam distillation.
- Able to check the purity of organic compound and the progress of reaction by performing TLC techniques individually.
- To provide knowledge for the isolation of natural products experimentally by various methods.

### **Paper VI: Separation and identification of organic compounds and column chromatography**

- Able to separate the organic compounds by column chromatography.
- Helps in developing practical skills for the separation of organic mixtures.

## Semester-IV

### Paper- I Drug design and drug discovery

- To know about the discovery of drugs, its pharmacokinetics and pharmacodynamics action.
- To understand the relationship between structure and biological activity of drugs.
- To know the importance of physicochemical property for drug action.
- To understand the combinatorial approach on drug synthesis, structure determination.
- The aim of CADD is to cover a wide range of computational methods for discovery of new drugs with benefits like cost saving, insight knowledge of drug receptor interaction, speed up discovery and development.

### Paper-II Drug synthesis and mechanism of action

- To study the synthesis of different drugs including chiral drugs.
- To understand the mechanism of action of different drugs acting on cell wall, DNA, immune system and ion channel.
- To know the mechanism of chiral drug action and their pharmacological activity.

### Paper-III Advanced Heterocyclic Chemistry

- The course gives the quantitative ideas about the synthesis of heterocyclic compounds and its properties.
- Heterocyclic compounds are very interesting due to their distinct structure and the availability of heterocyclic ring in medicinal drugs.
- Heterocyclic compounds are important in the synthesis of different drugs.
- To predict various methods of ring synthesis, reactivity and its applications in heterocyclic chemistry.
- To apply the knowledge of heterocyclic chemistry in the development of drugs.

### Paper- IV Advanced Natural Products

- Natural products provide a rich source for the therapeutic discovery and development of drugs.
- This course provided a brief introduction of the important classes of compounds from plant.
- A stress will be put on biosynthesis analysis of structure and pharmaceutical perspectives.
- It helps to analyze structures of natural products by using spectral methods.
- It also helps to gain knowledge in designing of synthesis of natural products.

**Practicals:****Paper V: Spectroscopic identification of organic compound and practice of chemistry software program**

- Able to interpret of the structure of organic compounds by analyzing spectral data using advanced spectral techniques.
- Able to draw the chemical structure by using chemdraw.

**Paper VI: Synthesis and analysis of drugs**

- Gains knowledge in synthesizing the drugs and estimating the purity of drugs by using the techniques and principles of experiments.

**SAROJINI NAIDU VANITA MAHA VIDYALAYA**  
**DEPARTMENT OF PHYSICS AND ELECTRONICS**

**Name of the Program: M.Sc., PHYSICS(ELECTRONICS AND INSTRUMENTATION)**

**Program Objective:**

The Master of Science in Physics Program provides the candidates with knowledge , general competence, Analytical skills on an advanced level, needed in industry , Consultancy , Education , Research or Public administration. E and I specialization provides a brief knowledge of measurements and measuring Instruments, so that students gain sufficient information of measurements in any kind of industry viz. electrical ,electronics, mechanical etc.

The candidate understands the role of physics in society and has the background to consider Ethical problems and the value of life long learning .Students gain the ability to successfully carry out advanced tasks and projects both independently and in collaboration with others or through PhD studies in physics.

## **M.Sc Physics Curriculum Objectives**

### **Semester I**

#### **Paper I (Mathematical physics)**

##### **Unit I:**

They identify Legendre's, Bessel's and associated differential equations and obtain their polynomials from generating function and Rodrigues formulae.

##### **Unit II:**

They identify Hermite and Laguerre differential equation and obtain the expression for Hermite and Laguerre polynomials and writing generating function of Hermite and Laguerre differential equations.

##### **Unit III:**

They identify the properties of Fourier and Laplace transform, and to solve problems based on Fourier Transform and Laplace transform and finding inverse Laplace of equation by convolution theorem.

##### **Unit IV:**

They come to know about matrix and tensor properties along with their difference,

#### **Paper II (Classical mechanics)**

##### **Unit I**

Students will be able to understand the true nature of Newtonian mechanics, Lorentz transformation equations, describe planar and spatial motion of rigid body.

##### **Unit II**

To understand the fundamental concepts in Lagrangian formulation of mechanics and to represent the equations of motion for complicated mechanical systems using it.

##### **Unit III**

To represent the equations of motion for complicated mechanical systems using Hamiltonian formulation of classical mechanics.

##### **Unit IV**

Students will be able to define and understand basic mechanical concepts related to discrete and continuous mechanical systems.

#### **Paper III (Quantum mechanics)**

##### **Unit I**

Student identifies correctly the mathematical space that contains all possible states of a physical system using Dirac's notation.

Student computes the probability of finding the system in a given state given that it was prepared in another given state.

##### **Unit II**

Students compute the energy eigen values and evolution of the quantum simple harmonic oscillator and evolution of a particle in a box.

##### **Unit III**

Student finds the transmission and reflection coefficients for one dimensional barriers.

##### **Unit IV**

Student finds the commutation relations for linear angular momentum.

#### **Paper IV (Solid state physics)**

##### **Unit I**

Students gain basic knowledge of crystal systems and spatial symmetries, concepts like structure factor, and able to account for how crystalline materials are studied using diffraction.

## **Unit II**

Students understand vibrational properties of solid state system, know what phonons are and be able to perform estimates of their dispersive and thermal properties.

## **Unit III**

Students will be able to know Bloch's theorem and about energy bands, fundamental principles of semiconductors and to estimate the charge carrier mobility and density.

## **Unit IV**

Students will understand the various defects exists in the formation of crystals, color centers, how the macroscopic properties of solids result from their microscopic, atomic scale properties.

## **Semester II**

### **Paper I (Electromagnetic theory)**

#### **Unit I**

To familiarize the students with different concepts of electrostatic, magnetostatic and time varying electromagnetic systems. To analyze Maxwell's equations in different forms and apply them to solve various electromagnetic field problems.

#### **Unit II**

Students are exposed to the ideas of plane em waves, their propagation in different media, power flow, polarization.

#### **Unit III**

Students gain knowledge about boundary conditions, plane em wave reflection and transmission at boundaries, Fresnel's equations, metallic reflection and dispersion.

#### **Unit IV**

Students will be able to understand wave equations for potentials, retarded potentials, oscillating source and able to explain electric and magnetic dipole radiation, linear antenna.

### **Paper II ( Statistical mechanics)**

#### **Unit I**

Students will have basic idea of phase space, micro state, macro state and provides the idea of probability to the particles.

#### **Unit II**

Students have the insight of postulates of statistical physics and learn which particles follow which statistics and why.

#### **Unit III**

Students apply the statistical distribution in real life problem and understand their problem. Many real system of particles will be dealt throughout the course to relate the theoretical knowledge to practical one.

#### **Unit IV**

Students will be able to compute the fluctuation in the number of particles in the system at constant  $V$  and  $T$ .

### **Paper III ( Quantum mechanics)**

#### **Unit I**

Student is able to explain the Dirac equation and its free-particle solutions.

#### **Unit II**

Students will be able to know how to express observables in fieldtheory in terms of annihilation and creation operators.

#### **Unit III**

Study the Stark effect, characters of hydrogen atom.

**Unit IV**

Study the wkB approximation method.

**Paper IV (Electronics)****Unit I:**

They come to know basic Analog Circuits and there Applications, To understand Basic construction of Feedback Circuits and their applications in Oscillators , to understand basic amplifier circuits and there applications in analog circuits

**Unit II:**

To understand basic function of OP-Amp ,Ideal and practical characteristics and their mathematical applications, they understand construction of Comparators and their applications in Electronics,

they understood types of Multivibrators and Wave Form generators Using Ic 555

**Unit III:**

They come to know about introduction of Flipflops , Registers ,counters and Shift registers,at the end of course students be able to recognize and analyze basic logic circuits.

**Unit IV :**

To understand basic architecture of 8-bit microprocessor, able to write programs on 8085 microprocessor. Develop skills in assembly language programme

**Semester III****Paper I (Modern optics)****Unit I**

Students will be able to understand principles involved in the interactions between light and matter, the requirements for a system to act as a laser.

Provides students a thorough understanding of fundamentals of lasers, their unique properties.

**Unit II**

To differentiate the various types of lasers and their means of excitation, assess which laser would best meet the need for a particular industrial or research task

**Unit III**

Students will understand the fundamentals ,techniques and applications of holography and Fourier optics.

**Unit IV**

To expose the students to fundamental concepts of non linear optics, second harmonic generation ,self focusing of light, phase matching considerations.

**Paper II ( Advanced solid state physics)****Unit I**

Students will be able to account for what Fermi surface is and how it can be measured, effect of electric and magnetic fields on it.

**Unit II**

To understand about dielectrics and to measure dielectric constant of a solid and their behavior, ferroelectric crystals classification ,polarization.

**Unit III**

Students will understand magnetic properties of solids along with the theoretical methods of quantum mechanics, statistical mechanics.

**Unit IV**

Students gain knowledge about super conductivity , types of super conductors , concepts of high temperature super conductors and their applications which provides essential background for beginning research in condensed matter.

### **Paper III ( Electronic Instrumentation )**

In this paper Students are going to study,

#### **Unit I**

How the errors are occurring in measuring system and how to test the system performance by using different input signals.

#### **Unit II**

About concept of amplifiers & filters and their importance in instrument design.

#### **Unit III**

About various signal generators and spectrum analyzers. And also the types of distortions in the instrument.

#### **Unit IV**

The concept of different types of measuring and recording systems and also about displays.

### **Paper IV ( Microprocessor, DSP and Interfacing )**

In this paper Students are going to study,

#### **Unit I**

About architecture of 8086 microprocessor and how to interfacing various ICs to the microprocessor in system design and also how to write assembly language programs and run on 8086 based system.

#### **Unit II**

About how to interface various ICs to 8086 while designing 8086 microprocessor based systems. And also difference between 16-bit, 32-bit and also multi core processors and their architectures.

#### **Unit III**

About a special purpose DSP processor and its usage in day to day life.

#### **Unit IV**

About various addressing modes and Instructions of DSP processor.

### **Semester IV**

#### **Paper I (Nuclear physics)**

##### **Unit I**

Students understand about nuclear forces and nuclear models using quantum mechanical theories.

##### **Unit II**

Students will be exposed to understand the theories of three types of radioactive decay ( $\alpha$ ,  $\beta$ ,  $\nu$ ), nature of  $\alpha$ ,  $\beta$  spectra, multipole radiation.

##### **Unit III**

To compare the relative penetrating power of three types of nuclear radiation

To understand interaction of radiation with matter and energy loss mechanisms, identify and explain the general operation of gas-filled, scintillation and semi conductor detectors.

##### **Unit IV**

Helps students to learn about nuclear reactions, characteristics, fusion and fission reactions and information about nuclear structure.

#### **Paper II (Spectroscopy)**

##### **Unit I:**

Describes the atomic spectra of one and two valence electrons of atoms

##### **Unit II:**

Describes the Molecular Spectra and its salient features and explains Rotational Vibrational spectra of atoms.

**Unit III:**

Describe Raman and IR spectra and how fourier principle used in spectrophotometer.

**Unit IV:**

Describe Electron spin and nuclear magnetic resonance spectroscopy and there applications.

**Paper III ( INSTRUMENTATION FOR MEASUREMENT, CONTROL,  
DATAACQUISITION AND DATA TRANSMISSION )**

In this paper Students are going to study,

**Unit I**

About concept of transducers and their usage in measuring physical parameters.

**Unit II**

About pressure measuring transducers and flow measurement meters.

**Unit III**

the importance of open & closed loop control systems in designing various process control systems and also about the concept of servomechanism.

**Unit IV**

About various data transmission and telemetry systems.

**Paper IV ( Embedded systems and Its applications )**

In this paper Students are going to study,

**Unit I**

Various types of architectures, CISC and RISC processors, architecture of 8051 microcontroller and its importance in embedded system design.

**Unit II**

Concept of timers & counters in 8051, the importance of interrupts and also serial communication.

**Unit III**

Difference between 8051 and PIC microcontrollers, architecture and pin diagram of different types of PIC controllers.

**Unit IV**

How to interface various ICs to microcontrollers in designing embedded systems and also how to control various motors by the microcontrollers.

# SAROJINI NAIDU VANITA MAHA VIDYALYA

## DEPARTMENT OF ZOOLOGY

### Program Outcomes

- MSC Zoology programme in Sarojini Naidu Vanita Maha Vidyalaya enables the students to extend their knowledge in different branches of zoology and as well as life sciences.
- This programme is a multidisciplinary study which completely gives knowledge about the various branches of life sciences like animals, their evolution, animal physiology, their behaviour, habit, habitat, molecular level organisation of the biomolecules and their mechanisms, laboratory techniques, Research knowledge, environmental study, immunology, systems biology, agriculture and fish biology.
- The students can opt their career options in different fields like public sectors, zoologists, forest department, laboratories, medical coding, medical analysis, scientific writers, lab technicians, teaching sectors, agriculture units, fisheries department, research etc.

### Paper outcomes

#### Semester - 1

##### 1. Structural biology

- This paper deals with the cells, biomolecules and their functions in detail which enables the students to get more knowledge of the cell
- Enzymes and their functions, metabolic cycles are dealt in detail which helps to understand clearly each and every function of the enzyme in the body.
- The events in the cell and the cellular organisation and the functions of the cell are also included along with the theories which enlightens the students about the cell in detail.

##### Outcomes:

One can excel in their career in the laboratories with the knowledge from this paper.

This information also helps in the research work also.

##### 2. Environment and Conservation Biology (ECB)

- The concepts of ecology and ecosystems enables the students to understand different ecological aspects.
- Students learn about the Biogeographical regions of India, flora and fauna, natural resources and their management.

##### Outcomes:

There will be a better scope for the students in future where the environmental conservation is a major aim of the society.

They can also work under NGO's as per their enthusiasm.

### 3. Immunology:

- The immunological concepts dealt in this paper helps the students to understand the concept immunology in detail along with the cells and their mechanisms for the immunizing the body.
- Concepts like hypersensitivity, transplantation helps them to understand the immunology better and to the fullest.
- Tumors, tumor immunology enables them to understand the concept of cancer, the cells responsible, body's reaction to those cells.

#### Outcomes:

Students can get opportunities in the immunological labs with the techniques dealt in the paper.

This information given in the paper immunology helps them to in the research also.

Knowledge of tumors and the tumor immunology helps them to have a clear knowledge of cancer.

### 4. Taxonomy, systematic and Functional Anatomy of Invertebrates ( TSFAI)

- This paper is based on the study of Invertebrates in detail.
- Evolution of the multicellular organisms from the unicellular organisms, protozoa to echinodermata all are dealt along with the interesting characteristics fractures of each and every phylum.
- Minor phyla and the other small phyla and parasites are also included.

#### Outcomes:

This paper gives the clear knowledge of the microscopic, unicellular, multicellular organisms and the animals without a vertebral column.

This knowledge helps them to plan their career in the researches based on the microorganisms and lower level organisms and also helps them to work as a parasitologists.

## **Semester – 2**

### 5. Tools, Techniques and Biostatistics (TTB)

- Knowledge about the tools, their maintenance and application enables the students to understand the mechanism, working and application of the tools of the laboratories.
- Separation techniques and diagnostic techniques gives the knowledge about the different techniques applied for the separation of different cellular components and diagnosis of them.

- Biostatistics helps them to understand the sampling techniques, measurements, theories of probabilities etc.

Outcomes:

With this knowledge the students can explore their career in different scientific laboratories as lab technicians, analysts etc.

The bio- statistical information plays a key role in the research works, students can plan their career as biostatistic analyst.

6. Animal physiology

- Different metabolic aspects like digestion, respiration, circulation, osmoregulation, thermoregulation, etc are dealt in this paper which enables the students to understand the physiological concepts in detail
- Neurophysiology, receptors and muscle physiology helps the students to understand the physiological events and step by step process for each function in the body.
- Endocrinology gives a clear information about the glands and the hormones.

Outcomes:

The physiological study of the animals enables them to pursue their career in the research.

They can also excel in the laboratories also.

7. Molecular genetics and Developmental biology (MGDB)

- The concept of genetics and the theories explaining the genetic are included in this paper which helps the students to understand the genetic in detail.
- Molecular genetics like hybridization, cloning enables the students to understand the applied molecular biology.
- Step by step developmental aspects, events and the changes from event to event gives a clear knowledge of the development of an organism along with the study of the organ formation and the organ development.

Outcomes:

Students can explore their career in the branches of genetics like laboratories, gene engineering and the applied molecular biology.

They can also plan their career as a developmental advisors in the gynecology departments.

8. Evolution and functional anatomy of vertebrates (EFAV)

- The evolution of the vertebrates from the invertebrates is included in this unit through which the students can understand the evolutionary link of each and every phylum.

- The functional anatomy of vertebrates from fishes to mammals draws a comparison between all three different phylum which enhances the comparative knowledge among the phyla.
- Connecting links between every phylum helps to understand the differences and similarities among the phyla.

Outcomes:

This paper enables the students to carry out research among the phyla and also the extinct organisms also like archaeologists.

There will be a high demand for the zoologists in the future.

**Semester – 3**

9. Systems biology

- The actual concept of the systems biology is explained in this unit which completely enhances the view of each and every scientific aspect.
- Mammalian biological clocks, the biochemical networks and the connectivity of all the aspects taking place in the body in a whole can be understood in this unit.
- The applications of the systems biology in the day to day living helps students to plan their career accordingly.

Outcomes:

Systems biology is the new trend where the whole system is considered instead of a single organ or an issue.

This knowledge enables the students for the holistic approach which will be the future of the medical sciences and life sciences.

10. Research methodology

- This paper purely deals about the steps of the research and the research proceedings which help the students the concept of research in detail.
- The applications of the statistical methods helps the students to know how to apply the statistical in the research.
- The final report of the research, rules and regulations helps the students to know the laws and the necessities for a research publication.

Outcomes

This paper purely helps the students to plan their career in the research.

Students who are interested in research and who want to opt the research as their career thus paper helps them to explore the nooks and corners of the research from basic to detailed knowledge.

11. Comparative Animal Physiology – 1

- This paper enables the students to gain the knowledge of different physiological events like digestion, nutrition, respiration, osmoregulation, excretion and thermo regulation in a comparative of all the living organisms starting from microorganisms to higher vertebrates.
- Deranged metabolism and disorders clearly states the disorders due to metabolic errors through which students can understand the metabolic disorders

Outcomes:

Students can plan their career as zoologists

They can also work under the animal laboratories as they will be having the knowledge of each and every physiological event in a comparative way.

12. Sericulture

- This paper is purely based on the silk worm rearing and culturing through which students can understand the techniques of silk worm rearing.
- This paper gives information about the mulberry cultivation, diseases of mulberry and maintenance through which students can understand the process and maintenance of monoculture.
- The biology of the silk worm, diseases and their maintenance is included along with the industrial production of the silk fiber which enlightens the students about the maintenance and marketing of the silk.

Outcomes:

Students can plan their career in organising a moriculture unit or mulberry cultivation.

This paper also helps them to set up their own sericulture unit as an occupation and also the feeling or dying industry.

They are eligible to work in Central Silk Board (CSB).

**Semester – 4**

13. Animal biotechnology

- This paper deals with the application of the biotechnological techniques for the improvement of animals which helps the students to understand the concept animal biotechnology.
- Various culture and cloning techniques enhances the students about the process and the requirements of particular experiments.
- Production of different animals with desired qualities and their applications helps students to understand the importance of the cloning and culturing techniques.

Outcomes:

Students can work under the biotechnological laboratories

This knowledge also helps the students to proceed for the research.

#### 14. Fish Biology

- This paper deals with the evolutionary aspects and ancestors of the fishes which are the first vertebrates and completely aquatic animals which helps the students the evolution of Invertebrates to vertebrates.
- The connecting links between each and every class of the fishes enables the students to understand the evolutionary progress between the ancestral and present day fishes.
- The morphology, mechanism and the embryogeny of the fishes is clearly explained in this unit which helps the students to understand in detail about the physiological as well as morphological aspects of fishes.

#### Outcomes:

Students can plan their career in the fisheries.

The knowledge about the fishes help them to carry out research.

#### 15. Comparative Animal Physiology – 2

- The response of animals to the environment and the effects of response in a comparative way is explained in this paper which helps the students to understand the reaction of each and every organism and it's response in different conditions.
- Circulation and the body fluids, control of reproduction and adaptations are included where students can understand the different circulatory mechanisms and different body fluids of animals in a comparative way along with the control and factors for the control of reproduction.

#### Outcomes:

Students can plan their career as a zoologists as they clearly know each and mechanism in the animals in a clear and comparative way.

The information in this paper also helps them to carry out research.

#### 16. Project work

- This project work which is included as a paper helps the students to experience the process of research and inculcated the interest of the students to the researches.
- Students who want to plan their career as a researchers this project work paper helps them to practically understand the research methodology.
- This project work helps students to explore different scientific fields under the life sciences for their project presentation.
- The students will get a exposure and they will get a chance to interact and work with the laboratories, hospitals, research scholars etc which helps them to plan their career.