GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE,

RAJNANDGAON (C.G.)

DEPARTMENT OF CHEMISTRY

PROGRAMME OUTCOMES AND COURSE OUTCOMES
2023-24

EXPECTED LEARNING OUTCOMES

PROGRAM SPECIFIC OUTCOME

Ph.D. (CHEMISTRY)

The purpose of the **Ph.D.** (Chemistry) program provided by the Dept. of Chmestry at Govt. Digvijay PG Autonomous college is to provide the key knowledge, base and laboratory resources to prepare students for achieving their career goals as professionals in the field of chemistry and allied science. Students will be able to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments. Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems. Students will become aware of the ethical behavior in issues facing chemists including an understanding of safe handling of chemicals, environmental issues and important issues being faced by our society such as energy, health and medicine.

EXPECTED LEARNING OUTCOMES

PROGRAM SPECIFIC OUTCOME (M.Sc. Chemistry)

The purpose of the M.Sc. (Chemistry) program at Govt. Digvijay PG Autonomous college is to provide the key knowledge, base and laboratory resources to prepare students for achieving their career goals as professionals in the field of chemistry, biological chemistry and related fields.

LEARNING OUTCOMES

- ✓ Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in Analytical, Inorganic, Organic and Physical Chemistries.
- ✓ Students will be able to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.
- ✓ Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.
- ✓ Students will be able to clearly communicate the results of scientific work in oral, written and electronic formats to both scientists and the public at large.
- ✓ Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.
- ✓ Students will appreciate the central role of chemistry in our society.
- ✓ Students will become aware of the ethical behavior in issues facing chemists including an understanding of safe handling of chemicals, environmental issues and important issues being faced by our society such as energy, health and medicine.

COURSE OUTCOMES

M.Sc. (CHEMISTRY) SEMESTER – I

PAPER- I : CO-ORDINATION CHEMISTRY

- ✓ Students will understand the theories of chemical bonding in co-ordination chemistry.
- ✓ Students will understand the metal π –Complexes, π-acceptor ligands, 18 e- rule, Hepaticity, Sandwich compounds, etc.
- ✓ Students will interpret metal ligand equilibria in solution through stepwise and overall formation constants. chelate effect, inert and labile complexes.
- ✓ Students will have an understanding of reaction mechanism of transition metal complexes through kinetics of octahedral substitution, acid hydrolysis, the trans effect, etc.

PAPER- II : BASICS OF ORGANIC CHEMISTRY AND REACTION MECHANISM

- ✓ Students will develop an understanding of nature of bonding in organic molecules. aromaticity, anti-aromaticity, homo-aromaticity, various reaction intermediates.
- ✓ Students will develop an understanding about elimination reaction mechanisms, aliphatic and aromatic nucleophilic substitution mechanisms.
- ✓ Students will develop an understanding about aliphatic electrophilic substitution, aromatic electrophilic substitution, etc. through examples.
- ✓ Students will learn about addition to carbon – carbon multiple bonds, carbon-hetero multiple bonds, Grignard reagent, organo zinc and organo lithium reagents.

PAPER- III : MATHEMATICS FOR CHEMISTS, QUANTUM CHEMISTRY AND CHEMICAL DYNAMICS

- ✓ Students will be able to perform mathematical analysis of vectors, matrix algebra and probability, rules and applications of differentiation and integration
- ✓ Students will have an insight into the atomic structure, quantum Chemistry, Schrodinger equation and its application, basic idea about angular momentum.
- ✓ Students will study the application of Schrodinger equation to multielectron system through approximate methods.
- ✓ Students will get acquainted with the basics of chemical dynamics, Photochemical reaction, Homogeneous catalysis, kinetics of enzyme reaction, fast reaction.

PAPER- IV : GROUP THEORY, PRINCIPLES OF SPECTROSCOPY AND COMPUTER FOR CHEMISTS

- ✓ Students will study symmetry and group theory in chemistry and will be able to imagine and visualize the point group,
- ✓ Students will get acquainted with the unifying principles of spectroscopy like uncertainty relation, natural line width, selection rules, Born-Oppenheimer approximation, energy levels, etc.
- ✓ Students will get acquainted with the basics of computers and computing, computer programming in 'C' Language.
- ✓ Students will learn atomic absorption spectroscopy, its basic principle, instrumentation and applications in soil and water analysis.

LABORATORY COURSE I : PHYSICAL CHEMISTRY

- ✓ Students will perform study surface tension – concentration relationship, chemical kinetics and experiments related to phase equilibria, solutions, polarimeter, conductometry, potentiometry/pH metry, etc.

LABORATORY COURSE II : INORGANIC CHEMISTRY

- ✓ Students will be capable of carrying out qualitative and quantitative analysis, volumetric and gravimetric methods.

M.Sc. (CHEMISTRY) SEMESTER – II

PAPER- I : TRANSITION METAL COMPLEXES AND DIFFRACTION METHODS

- ✓ Student will have an Understanding of Electronic Spectra of Transition Metal Complexes
- ✓ Students will understand the Magnetic Properties of Transition Metal Complexes
- ✓ Students will learn X-Ray Diffraction Concept and Electron diffraction
- ✓ Students will acquainted with the basics of Neutron Diffraction, Metal clusters and Isopoly and Heteropoly Acids and Salts.

PAPER- II : REACTION MECHANISM, REARRANGEMENTS AND REAGENTS

- ✓ Students will study Stereochemistry and Conformational analysis in chemistry and will be able to predict the structure and orientation of optically active organic compound.
- ✓ Students will understand pericyclic reaction with many examples.

- ✓ Students will study Carbohydrates, Lipids and their many types. Students will understand the structure and functions of Peptides, Proteins and Nucleic Acid

PAPER- III : THERMODYNAMICS, ELECTROCHEMISTRY AND SURFACE CHEMISTRY

- ✓ Students will learn the basics of Classical Thermodynamics.
- ✓ Students will study the Statistical Thermodynamics and their Theories.
- ✓ Students will understand Theories of Electrochemistry and Electrocatalysis.
- ✓ Students will acquainted the Surface Chemistry and they will be able to imagine the structure of Micelles and Macromolecules.

PAPER- IV : SPECTROSCOPY

- ✓ Students will understand Instrumentation and working procedure of Molecular Spectroscopy and Microwave spectroscopy.
- ✓ Students will study the Infrared spectroscopy, Raman Spectroscopy and their Instrumental Techniques.
- ✓ They will be able to predict structural properties of compound.
- ✓ Students will study Nuclear Magnetic Resonance Spectroscopy and Nuclear Quadruple Resonance Spectroscopy.
- ✓ Students will acquainted The Photoelectron Spectroscopy, Photo acoustic Spectroscopy and Electron Spin Resonance Spectroscopy.

LABORATORY COURSE : ORGANIC CHEMISTRY PRACTICAL

- ✓ The students have been taught different analytical techniques like saponification, different organic compound preparation and best knowledge of instruments like pHmeter and conductometer.

LABORATORY COURSE : ANALYTICAL CHEMISTRY & COMPUTERS PRACTICAL

- ✓ Students will learn error analysis, statistical data analysis, volumetric analysis, chromatography, flame photometry / AAS / FIA, spectrophotometry, nephelometry / turbidimetry, etc.

M.Sc. (CHEMISTRY) SEMESTER – III

PAPER- I : CHROMATOGRAPHIC TECHNIQUES AND APPLICATIONS OF SPECTROSCOPY

Students will learn about the instrumentation and application of various spectroscopy instruments like FTIR, UV-VIS, NMR, MASS spectra etc. for the structural determination of organic and inorganic molecules

PAPER- II : BIO-CHEMISTRY AND BIOMOLECULES

This section deals with metal and their significant role in biological process like respiration, photosynthesis and catalytic activities.

PAPER- III : ORGANOTRANSITION METAL COMPLEXES

Organometalic chemistry is the major part of chemistry which deals with synthesis and chemical properties like catalysts, drugs of synthesized organometallic complexes

PAPER- IV : PHOTOINORGANIC AND ANALYTICAL CHEMISTRY

This unit contains brief analysis of various photoinorganic reactions and role of instruments those are used in structural elucidation of molecules.

LABORATORY COURSE I : ANALYTICAL CHEMISTRY PRACTICALS

The students have the detailed knowledge of analytical ore analysis of different element, quantitative organic compound analysis and also have the spectroscopic determination method.

LABORATORY COURSE II : PROJECT WORK

Students will perform project work to understand scientific methodologies and research activity.

M.Sc. (CHEMISTRY) SEMESTER – IV

PAPER- I : PHOTOCHEMISTRY AND SOLID STATE CHEMISTRY

- ✓ Understanding of Photochemical reaction, determination of reaction mechanism of photochemical reaction.
- ✓ Understanding of Photo Fries Rearrangement and Barton reaction.

- ✓ Understanding of solid state chemistry, crystal structures of various ionic compound, defects.
- ✓ Understanding of electronic properties & band theory of insulator, conductors and semiconductors.
- ✓

PAPER – II : ENVIRONEMNTAL CHEMISTRY

- ✓ Development of understanding of environment, biogeochemical cycles of C.N.P.S.
- ✓ Understanding of quality of water and its qualitative analysis, treatment of water pollutant.
- ✓ Understanding of air pollution and its causes.
- ✓ Detailed knowledge of various industrial pollutants, toxicology.

PAPER- III : BIO-INORGANIC AND SUPRAMOLECULAR CHEMISTRY

- ✓ Detail knowledge about Bioinorganic and supramolecular & photo inorganic chemistry.
- ✓ Metalloenzymes- understanding of metalloenzymes and their functions in human body/living body.
- ✓ Detail knowledge about metal chelates as medicine, study about synthetic approach of antibiotics.
- ✓ Understanding about Supramolecular chemistry .

PAPER- IV (A): CHEMISTRY OF MATERIALS & RADIOCHEMISTRY

- ✓ Detailed knowledge about glasses, ceramics, composites & non-materials.
- ✓ Understanding of Microscopic composites, nanomaterials.
- ✓ Understanding about Principle and application of TGA, DTA, & DSC.
- ✓ Understanding of Radiation Chemistry, radio analytical techniques.

PAPER- IV (B): POLYMER CHEMISTRY

- ✓ Understanding of Polymer Chemistry
- ✓ Understanding of synthesis of polymers
- ✓ Understanding of properties of polymers

LABORATORY COURSE I : PROJECT WORK

Students will perform project work to understand scientific methodologies and research activity.

LABORATORY COURSE II : ANALYTICAL CHEMISTRY PRACTICAL

The students have a wide range of experiments related to analysis of alloy ores and minerals and extraction of organic compounds from natural products.

EXPECTED LEARNING OUTCOMES

B.Sc. (Subject - Chemistry)

PROGRAM OUTCOMES

- ✓ Students will have a basic knowledge of fundamentals and application of current chemical and scientific theories.
- ✓ Students will be able to record and analyze the results of experiments.
- ✓ Students will be skilled in problem solving, critical thinking and analytical.
- ✓ Students will understand the central role of chemistry in our society.
- ✓ Students will become aware of the ethical behavior in issues facing chemists.

PROGRAM SPECIFIC OUTCOME

The purpose of the B.Sc. program at Govt. Digvijay PG Autonomous college is to provide the key knowledge. base and laboratory resources to prepare students for achieving their career goals as professionals in the field of chemistry, biological chemistry and related fields. They will be able to work as chemists and technicians in different laboratories.

B.Sc. III year (Subject - CHEMISTRY)

PAPER - 1 (Inorganic Chemistry)

Unit 1 - This unit give important information about metal-ligand bonding in transition metal complexes and types of ligand.

Unit 2 - Student gains important information about magnetic properties of transition metal complexes.

Unit 3 - Students gains the knowledge of organometallic compounds and their chemical reactions.

Unit 4 - Important elements and their important role in biochemistry will be discussed in this unit.

Unit 5 - In this unit concept of acid and base are discussed and the inorganic polymers will be explained.

PAPER - 2 (Organic Chemistry)

Unit 1 - Students will get information regarding the classification, nomenclature, structure, synthesis and properties of heterocyclic compounds.

Unit 2 - Students give the knowledge of different organometallic compounds and organic synthesis via enolates.

Unit 3 - Students the knowledge of biomolecules and their important roles in chemistry and daily life.

Unit 4 - Students gains the knowledge of dyes and polymers, types of biopolymers, formation, their properties and uses.

Unit 5 - This unit gives information about mass, infrared and UV/Visible spectroscopy, basic principles of these spectroscopy, NMR and 13C Spectroscopy their principle and applications.

PAPER - 3 (Physical Chemistry)

Unit 1 - Students will know about the structure of atom, orbitals and importance of quantum mechanics in chemistry.

Unit 2 - From this unit students gain the knowledge about applications of quantum mechanics.

Unit 3 - This unit gives information about mass, infrared and UV/Visible spectroscopy, basic principles of these spectroscopy, NMR and 13C Spectroscopy their principle and applications.

Unit 4 - Students gains the knowledge of Electrolytic conductance, Theories of strong electrolyte, Migration of ions.

Unit 5 - Students gains knowledge about Electrochemical cell and Galvanic cells, Single electrode potential, Concentration cell, Corrosion. .

LABORATORY COURSE

Students will understand preparation of complex, synthesis and analysis of organic compound, qualitative analysis and handling of instruments.

EXPECTED LEARNING OUTCOMES

B.Sc. (Subject - Industrial Chemistry)

PROGRAM OUTCOMES

- Students will have a basic knowledge of fundamentals and application of current chemical and scientific theories.
- Students will be able to record and analyze the results of experiments.
- Student will know about material balance, metal and alloys. manufacturing process important for industries.
- Students will learn about chemical processes and industrial economics.
- Students will be skilled in problem solving, critical thinking and analytical.
- Students will understand the central role of chemistry in our society.
- Students will become aware of the ethical behavior in issues facing chemists.

PROGRAM SPECIFIC OUTCOME

The purpose of the B.Sc. (Industrial Chemistry) program at Govt. Digvijay PG Autonomous college is to provide the key knowledge, base and laboratory resources to prepare students for achieving their career goals as professionals in the field of chemistry, biological chemistry and related fields. They will be able to work as chemists and technicians in different laboratories, industries, pollution control agencies, etc.

B. Sc. III (INDUSTRIAL CHEMISTRY)

PAPER- I : CHEMICAL PROCESS AND INDUSTRIAL ECONOMICS

- Student will know chemical estimation and cost accounting.
- Student will learn marketing policy, cost value, taxes on export or imports on material.
- Industrial sampling purchasing, raw material, collection data from area to area, particle and material determination, student know about quality assurance department and management about QA & QC.
- Industrial application, planning for material production or quality parameter control location for setup any industries.
- Safety management ,welfare the human resources.

PAPER- II : PHARMACEUTICALS

- Student will learn the pure history about Pharmaceuticals parameter, type for using routes of administration.
- It will help in nursing and sterilization process, and Parma industry and additives in medicine.

- Student will know about packaging and quality control process for raw material. F.D.A. process.
- Crude product for manufacturing pharmacy. all type chromatography process.
- Instruments handling on laboratory for analysis of material raw & final.

PAPER- III : DRUGS

- Student will know about effluent handling ,collection and cultivation of photochemical plants.
- Chemical constitution about isolation procedures for ingredients of medicine.
- Student will know about antimicrobial, analgesic, steroidal hormones drug.
- Student know about vitamin, barbiturates, blockers, cardiovascular, antihistamines medicine, role of its metabolism of medicine.
- Student know how to manufacturing of penicillin, vitamins, steroidal drug. its use or microbial effect. fermentation process.

LABORATORY COURSE

- Student will know how to manufacturing industrials compound like Benzes amide, aldehyde, alcohol, fatty oil and acid. determination of material packaging material.
- Limit test heavy metals & two representing bulk drug.
- Acidimetric and alkalimetry formulation of this type analysis. microbiological and antimicrobial testing zone and cup method.
- Know about TLC method for determination of few drug.

CERTIFICATE COURSE

On

Advanced Techniques for Soil and Water Analysis

PROGRAM SPECIFIC OUTCOME

The purpose of the certificate course on "Advanced Techniques for Soil and Water Analysis" program at Govt. Digvijay PG Autonomous college is to provide the key knowledge, base and laboratory resources to prepare students for achieving their career goals as professionals in the field of chemistry, biological chemistry and related fields.

LEARNING OUTCOMES

- Students will learn about the principle and procedure of soil analysis.
- Students will learn about the principle and procedure of water analysis.
- Students will learn about the principle and procedure of atomic absorption spectroscopy.
- Students will learn about the principle and procedure of for determination of various cations and anions..
- Students will learn about the principle and procedure of determination of soil moisture, pH, colour, turbidity, conductivity, acidity, alkalinity, DO, COD, BOD, hardness of water samples.

Add-on Course

on

Food Science & Quality Control

PROGRAM OUTCOMES

- Students will have a basic knowledge of fundamentals and application of food science & quality control.
- Students will be able to record and analyze the results of experiments.
- Students will be skilled in problem solving, critical thinking and analytical.
- Students will become aware of the ethical behavior in issues in this field.

PROGRAM SPECIFIC OUTCOME

The purpose of the Add-on course on Food Science & Quality Control program at Govt. Digvijay PG Autonomous college is to provide the key knowledge, base and laboratory resources to prepare students for achieving their career goals as professionals in the field of chemistry, biological chemistry and related fields. They will be able to work as chemists and food analysts in different laboratories.

COURSE OUTCOMES

First Year : Certificate

PAPER – I : BASIC NUTRITION

- Students will learn about source, function of foods, nutrients, malnutrition, inter-relationship between nutrition and health, good health, food guide, etc.
- Students will understand about water, minerals, Carbohydrates.
- Students will learn about lipids and vitamins.
- Enzymes nomenclature, specificity, etc and energy will be discussed.
- Amino Acids, Peptides and Proteins

Paper – II : FOOD MICROBIOLOGY, SANITATION & HYGIENE

- Students will learn about microbiology, morphology of micro-organisms, control of micro-organisms, effect of environmental factors, etc.
- Microbiology of different food spoilage and contamination, sources, types, effects, environmental microbiology, water, air, soil & sewage
- Microbial intoxication and infections, symptoms & methods of control, beneficial effects, microbiological standards, food safety.
- The relation of micro-organisms to sanitation, effect of micro-organisms on foods borne illness.

- Importance of personal hygiene of food handler, safety in food procurement, cleaning methods, sanitation, waste product handling, etc.

COURSE OUTCOMES

Second Year : Diploma Course

PAPER-I : FOOD PRESERVATION, SENSORY EVALUATION & FOOD PACKAGING

- Students will learn about basic concept of food preservation.
- Students will learn about Spoilage of food, nutritive value of preserved food
- Students will learn about palatability of food, measurement, sensory analysis, etc.
- Factors influencing sensory measurements, types of test, objective methods of evaluation, etc.
- Importance of packaging, various package forms, packaging materials, methods and performances, etc.

PAPER-II : POST HARVEST TECHNOLOGY & ANALYTICAL INSTRUMENTATION

- Students will learn about principles of food processing, processing technology, enrichment & fortification of food.
- Sprouting & fermentation, additives, preservatives, quality Control in food industry, etc.
- Basics of instrumentation like colorimetry, photometry, chromatography, electrophoresis.
- Principles & applications of different techniques used in food & nutrition research

Third Year : Advanced Diploma

PAPER – I : FOOD ANALYSIS AND FOOD TOXICOLOGY

- Enable students to develop new food products and entrepreneurial abilities.
- Food composition, emulsifiers, antioxidants, enzymes, etc and sampling technique.
- General chemical methods of analysis of carbohydrate, fat, protein, etc.
- Toxicology, food contamination, toxins, chemical preservatives, pestisides, etc.
- Food borne illness, microbial & parasitic food poisoning, parasites, etc.

Third Year : Advanced Diploma

Paper-II : Food Manufacturing Adulteration And Testing

- Students will learn about market research, consumer research, food consumption pattern, etc.
- Trends in social change, food situation in India and outside, prospects of food processing for export , product developing, etc.
- Food laws, states and Municipal laws, food Standard.
- Food Adulteration.
- Enterpreneurship, food laws, transporting –types/mode.