

**B.Sc.Semester IV**  
**Chemistry (Major 2)AnalyticalChemistry**  
**BS23MJ4CH2**

**Learning Objectives:**To acquire basic knowledge of the analytical chemistry of important techniques that will provide the basis for their industrial production methods. To provide an adequate mastery of analytical methods used for the determination of commercial/domestic raw materials and finished product quality.

**Learning outcomes:**By the end of this course, students will be able to: • Become familiar with fundamental concepts of quantitative and qualitative analysis. • Develop the core skills to comprehend and perform acid-base, redox and Complexometric titrations and gravimetric and volumetric analysis.

**UNIT-1 [A] Basic concept of Qualitative and Quantitative Analysis**

Introduction, solubility product principle, common ion effect, separation of Cations of each groups and separation of anion (acid radicals), Introduction of volumetric titration based on normality of the solution, condition for Volumetric analysis and types of titrimetric analysis.

**[B] Estimation**

Estimation of Acid(-COOH), 1°-Amine(-NH<sub>2</sub>), Aldehyde (-CHO) and Ketone (->C=O), Ether, -OH (alcohol and Phenol)

**UNIT-2 [A] Acid Base Titration:**

Theory of acid-base titration, Ways of locating the end point of acid-base, Titration of strong acid with strong base, Titration of weak base with strong acid, Titration of weak acid with strong base, Factors determining the exactness of a pH curve.

**[B] Redox titration**

Theory of redox titration, theoretical basis of volumetric analysis involving (i) Potassium Permanganate (ii) Potassium dichromate and (iii) Iodine, study of redox titration by electrochemical Potential Method(only).

**UNIT-3 Complexometric Titration**

Theory of Complexometric titration: principle, effects of complexing agents and their advantages, stepwise and overall formation constants, Study of EDTA Complex formation taking disodium salt of EDTA and effect of pH, Way of locating the end point by visual process and Instrument Process, indicators for EDTA titration-theory of metal ion indicators, titration methods employing EDTA – direct, back, displacement and indirect determinations, masking and demasking reagents, application of EDTA titration e.g. determination of hardness of water.

**UNIT-4 [A] Precipitation Gravimetric and volumetric:**

Introduction to gravimetric analysis, general principle, entire gravimetric procedure and gravimetric steps. Gravimetric Conversion Factor (GCF) - illustrations with reference to sulfate, chloride, ferric, calcium and phosphate as analyte ions. Precipitation: Saturation, super saturation, nucleation and crystal growth. Properties of precipitates-particle size, colloidal state; types of precipitates-crystalline, curdy and gelatinous precipitates.

**[B] Inorganic precipitants & organic precipitants :** Inorganic precipitants & organic precipitants advantages and disadvantages. Uses of inorganic precipitants: silver nitrate for chloride, dilute sulfuric acid for barium and lead, barium chloride for sulfate and ammonium hydroxide for iron. Uses of organic precipitants: dimethyl glyoxime for Nickel, 8-hydroxy quinoline for aluminum and  $\alpha$ -benzoin oxime (Cupron) for copper.

## REFERENCES

1. DhrubaCharan Dash, "Analytical Chemistry", PHI Learning Pvt. Ltd., NewDelhi,2011.
2. R.A.Day, A.L.Underwood, "Quantitative Analysis", Prentice-Hall of IndiaPvt.Ltd.,NewDelhi,2004.(Sixth edition)
3. Gary D. Christian, "Analytical Chemistry", John Wiely& Sons, INC, New York,1994.(Fifthedition)
4. Douglas A. Skoog, Donald M. West, F.James Holler, "Analytical Chemistry AnIntroduction", Saunders College Publishing, Harcourt Brace College Publishers,Philadelphia,1994.(Sixthedition)
5. Y.Anjaneyulu, K.Chandrasekhar, ValliManickam, "A Textbook of AnalyticalChemistry",Pharma Book Syndicate,Hyderabad,India,2006.

**B.Sc. Semester IV**  
**Chemistry(Major-3)**  
**Inorganic&Analytical Practical**  
**BS23MJ4CH3**

**Learning Objectives:** To impart the students, skills regarding semi micro analysis method of qualitative inorganic analysis, volumetric and gravimetric analysis.

**Learning out comes:** After completion of course students will be able to comprehend and perform semi micro qualitative analysis of inorganic mixtures and volumetric and gravimetric analysis of ions and metals.

**[A] Inorganic Mixture**

Semi micro method of analysis of inorganic mixture containing four radicals (excluding phosphate, arsenite, arsenate and borate) Minimum eight mixtures should be performed. Only watersoluble mixture.

**[B] Volumetric and Gravimetric Analysis:**

**Volumetric Analysis:**

- (a) Hardness of Water, Ca & Mg (Total Hardness) by EDTA
- (b) Estimation of Ni by using EDTA,  $MgCl_2$  and Eriochrome Black – T (Back Titration)
- (c) Determine the concentration of  $Cu^{2+}$  in the given solution by Colorimetry.

**Gravimetric Analysis:**

- (a) Fe as  $Fe_2O_3$
- (b) Ba as  $BaSO_4$
- (c) Al as  $Al_2O_3$

**REFERENCES**

1. Vogel's "Textbook of Quantitative chemical Analysis", Pearson Education Ltd. Sixth Edition, 2008.
2. Vogel's "Qualitative Inorganic Analysis", Pearson Education Ltd. Seventh Edition, 2009.
3. Gurdeep Raj, "Advanced Inorganic Chemistry", Goel Publishing House, Meerut, Volume-I, 24th Revised Edition, 1998.
4. John H. Kennedy, "Analytical Chemistry : Practice", Saunders College Publishing, New York, Second Edition, 1990.
5. R.A. Day, A.L. Underwood, "Quantitative Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, Sixth Edition, 2004.
6. Gary D. Christian, "Analytical Chemistry", John Wiley & Sons, INC, New York, Fifth Edition, 1994.

**B.Sc. Semester – IV**  
**Chemistry (Minor)**  
**Optical and Electro analytical Methods in Chemistry**  
**BS23MN4CH1**

**Learning Objectives:** The objective of this course is to make student aware of the laws of spectroscopy and selection rules governing the possible transitions in the different regions of the electromagnetic spectra. The course exposes students to the electroanalytical methods of analysis.

**Learning Outcomes:** By the end of this course, students will be able to: Understand basic principle of instrument like UV-visible spectrophotometer, learn various electrochemical analysis methods and their applications.

**UNIT - 1 Optical methods of analysis**

Optical methods of analysis: Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules. UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Transmittance. Absorbance and Beer-Lambert law. Examples related to above said topics.

**UNIT - 2 Electroanalytical methods**

Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values. Examples related to above said topics.

**REFERENCES**

1. Willard, H.H.(1988), Instrumental Methods of Analysis, 7th Edition, Wardsworth Publishing Company.
2. Christian, G.D.(2004), Analytical Chemistry, 6th Edition, John Wiley & Sons, New York.
3. Harris, D. C.(2007), Quantitative Chemical Analysis, 6th Edition, Freeman.
4. Khopkar, S.M. (2008), Basic Concepts of Analytical Chemistry, New Age International Publisher.
5. Skoog, D.A.; Holler F.J.; Nieman, T.A. (2005), Principles of Instrumental Analysis, Thomson Asia Pvt. Ltd.

**B.Sc. Semester - IV**  
**Chemistry Practical**  
**Inorganic Practical**

**Inorganic Mixture**

Semi micro method of analysis of inorganic mixture containing four radicals (excluding phosphate, arsenite, arsenate and borate) Minimum eight mixtures should be performed. Only water soluble mixture.

**REFERENCES**

1. Vogel's "Textbook of Quantitative chemical Analysis", Pearson Education Ltd. Sixth Edition, 2008.
2. Vogel's "Qualitative Inorganic Analysis", Pearson Education Ltd. Seventh Edition, 2009.
3. Gurdeep Raj, "Advanced Inorganic Chemistry", Goel Publishing House, Meerut, Volume-I, 24th Revised Edition, 1998.

**BSC Semester- IV (SEC)**  
**Basic Analytical Chemistry-II**  
**BSC23SE302**

**Learning Objectives:** The objective of this course is to make students aware about the important terms used in analytical chemistry and the concepts of chemical analysis of water and soil, using various manual as well as instrumental techniques.

**Learning Outcomes:** By the end of this course, students will be able to: Handle analytical data, Determine composition and pH of soil, which can be useful in agriculture, Do quantitative analysis of metal ions in water.

**UNIT-1: Introduction**

Introduction to analytical chemistry and its interdisciplinary nature, Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Significant figures. Presentation of experimental data and results.

**UNIT-2: Analysis of soil and water**

Composition of soil, concept of pH and its measurement, types of soil nutrients and their importance, determination of sulfur, iron, manganese, complex metric titrations, chelation, chelating agents, use of indicators.

Definition of pure water, sources responsible for contaminating water, hardness of water, types of hardness, determination of hardness, water sampling methods, water purification methods.

**REFERENCES**

1. Christian, G.D. (2004), Analytical Chemistry, John Wiley & Sons.
2. Harris, D. C. (2007), Exploring Chemical Analysis, W.H. Freeman and Co.
3. Skoog, D.A.; Holler F.J.; Nieman, T.A. (2005), Principles of Instrumental Analysis, Thomson Asia Pvt. Ltd.
4. Svehla, G. (1996), Vogel's Qualitative Inorganic Analysis, Prentice Hall.
4. Mendham, J.; Denney, R.C.; Barnes, J.D.; Thomas, M.J.K. (2007), Vogel's Quantitative Chemical Analysis, 6th Edition, Prentice Hall.

**Shri Govind Guru University, Vinzol**  
**B. Sc. Semester –IV**  
**BSC23VA401**  
**CONSTITUTIONAL VALUES AND FUNDAMENTAL DUTIES**

**Learning Objectives**

The Learning Objectives of this course are as follows: Enrich students with knowledge and relevance of the Constitution. Develop awareness about Duties and Values. Inculcate a sense of Constitutionalism in thought and action.

**Learning outcomes**

The Learning Outcomes of this course are as follows: Understand the Constitution and its relevance. Appreciate the values and goals embedded in the Constitution. Recognise the importance of Fundamental Duties enshrined in the Constitution. Apply the spirit of fundamental values and duties in everyday national life.

**UNIT- 1The Constitution of India - An Introduction**

Federal Republic, Rule of Law, Separation of Powers, Sovereignty, Socialism, Democracy, Secularism and Sarva Dharma SamaBhava

**Constitutional Values**

Justice: Social, Political, Economic, Liberty: Thought, Expression, Belief, Faith, Worship, Equality: Equality before law & equal application of laws, Fraternity: Dignity, Unity and Integrity

**UNIT- 2Fundamental Duties**

Reflecting on the ancient Indian notions of righteousness and duty consciousness, Fundamental Duties- Article 51A [(a)- (k)], Legal status of Fundamental Duties - Judicial approach.

**REFERENCES**

1. Durga Das Basu, et al., Introduction to the Constitution of India (LexisNexis, 26th edn, 2022).
2. Leila Seth, We, the Children of India: The Preamble to Our Constitution (New Delhi, Puffin Books, Penguin Books India, 2010).
3. Mahendra Pal Singh, V.N. Shukla's Constitution of India, (Eastern Book Company, Lucknow, 13th revised edn. 2017)
4. B.R. Ambedkar Selected Speeches, (PrasarBharati, New Delhi, 2019) available at: [https://prasarbharati.gov.in/whatsnew/whatsnew\\_653363.pdf](https://prasarbharati.gov.in/whatsnew/whatsnew_653363.pdf).

# **Shri Govind Guru University, Vinzol**

## **B. Sc. Semester –IV**

### **BSC23VA402**

#### **DIGITAL EMPOWERMENT**

##### **Learning Objectives**

The Learning Objectives of this course are as follows: Understand the digital world and need for digital empowerment. Create awareness about Digital India. Explore, communicate and collaborate in cyberspace. Building awareness on cyber safety and security.

##### **Learning outcomes**

The Learning Outcomes of this course are as follows: Use ICT and digital services in daily life. Develop skills to communicate and collaborate in cyberspace using social platforms, teaching/learning tools. Understand the significance of security and privacy in the digital world. Evaluate ethical issues in the cyber world.

##### **UNIT- 1 Digital inclusion and Digital Empowerment**

Needs and challenges, Vision of Digital India: Digi Locker, E-Hospitals, e-Pathshala, BHIM, e-Kranti (Electronic Delivery of Services}, e-Health Campaigns, Public utility portals of Govt. of India such as RTI, Health, Finance, Income Taxfiling, Education, Electronic Communication: electronic mail, biogs, social media, Collaborative Digital platforms, Tools/platforms for online learning, Collaboration using file sharing, messaging, video conferencing

##### **UNIT- 2 Towards Safe and Secure Cyberspace**

Online security and privacy, Threats in the digital world: Data breach and Cyber Attacks, Blockchain Technology, Security Initiatives by the Govt of India, Netiquettes, Ethics in digital communication, Ethics in Cyberspace.

#### **REFERENCES**

1. Rodney Jones and Christoph Hafner. "Understanding digital literacies: A practical
2. Introduction". Routledge Books, 2nd edition, 2021.
3. <https://www.digitalindia.gov.in>
4. <https://www.digilocker.gov.in>
5. <https://www.cybercrime.gov.in>
6. <https://www.cybersafeindia.in>
7. <https://www.meity.gov.in/cyber-surakshit-bharat-programme>



# **Shri Govind Guru University, Vinzol**

## **B. Sc. Semester –IV**

### **BSC23VA403**

#### **PROFESSIONAL ETHICS**

**Learning Objectives:** To make students aware about professional ethics, in the course students will be taught different professional ethics, laws and moral values. To inculcate Ethics and Human Values into the young minds. To develop moral responsibility and mould them as best professionals. To create ethical vision and achieve harmony in life.

**Learning Outcome:** By the end of the course student should be able to understand the importance of ethics and values in life and society. After the completion of the course students will be able to work in a professional manner in the organization.

#### **UNIT – 1 Ethics and Human Values**

Ethics and Values, Ethical Vision, Nature of Ethics, Profession and Professionalism, Professional Ethics, Code of Ethics, Ethical Decisions, Human Values – Classification of Values, Universality of Values.

**Corporate Social Responsibility (CSR):** Conceptual bases, Socially responsible leadership and CSR' role in corporate governance, Basic initiatives in the field of CSR and sustainable development. Corporate CSR reports, Globalization of CSR. Features of CSR of multinational corporations.

#### **UNIT – 2 Professional ethics**

Profession and its moral value in life, Profession- skill needed , Profession and ethics-commitment, honesty, accountability, Professional integrity, transparency, confidentiality, objectivity, respect, obedience to the law and loyalty.

**Safety Social Responsibility and Rights :**Safety and Risk, moral responsibility of technicians for safety, case studies – Bhopal gas tragedy, Chernobyl disaster, Fukushima Nuclear disaster, Professional rights, Gender discrimination, Sexual harassment at work place and laws regarding that.

#### **REFERENCES**

1. Chakraborty, S.K. Human Values for Managers
2. Badi, R.V. and Badi, N.V. Business Ethics, Vrinda Publications
3. Corporate Governance, 2 nd Edition, Mallin, OUP
4. Values and Ethics for Organizations, Chakraborty, OUP
5. Perspectives in Business Ethics, Hartman, Chatterjee

**Shri Govind Guru University, Vinzol**  
**B. Sc. Semester –IV**  
**BSC23VA404**  
**DIGITAL AND TECHNOLOGICAL SOLUTIONS**

**Learning objectives:** To gain familiarity with digital technologies. To sensitize about role & significance of digital technology. To provide know how of communications & networks. To bring awareness about the e-governance and Digital India initiatives. To provide familiarity with the emerging digital technologies.

**Learning outcomes:** After the completion of the course students will have: Knowledge about the digital paradigm, Realisation of importance of digital technology, digital financial tools, e-commerce; Know-how of communication and computer networks, Familiarity with the e-governance and Digital India initiatives, Understanding the latest digital technologies.

**UNIT- 1 Introduction**

Introduction and Evolution of Digital Systems, Role and significance of Digital Technology, Information & communication technology & tools, Computer system & its working, Software and its types, Operating Systems: types and functions.

**Communication Systems:** Principles, model & transmission media, Computer networks, Internet: concept and applications, WWW, Web Browsers, Search Engines, Messaging, E-mail, Social networking.

**Computer Based Information System:** significance and types, e-Commerce & digital marketing: basic concepts, benefits & challenges.

**UNIT – 2 Digital tools and their applications**

**Digital India & e-Governance:** Initiatives, Infrastructure, Services and Empowerment.

**Digital Financial Tools:** Unified Payment Interface, Aadhar enabled payment System, USSD, Credit/Debit Cards, e-Wallets, Internet Banking, NEFT/RTGS and IMPS, Online Bill Payments and PoS Cyber Security: Threats, Significance, Challenges, Precautions, Safety Measures & Tools.

**Emerging Technologies & their applications:** Overview of Cloud Computing, Big Data, and Internet of things. Virtual reality. Block chain, Robotics, Artificial intelligence, 3-D Printing, Future of digital technologies,

**REFERENCES**

1. Fundamentals of Computers by E Balagurusamy, Tata McGraw Hill.
2. Data Communication and Networking by Behrouz A, Forouzan, McGraw Hill Education.
3. Emerging Technologies in Computing: Theory, Practice, and Advances, by P. Kumar, A. Tomar and R. Sharmila, 1<sup>st</sup> Edition, 2021.
4. Essentials of cloud computing by K. Chandrasekharan, CRC press, 2014.
5. Blockchain: Blueprint for a new economy by M. Swan, O'Reilly Media, 2015.

**B. Sc. Semester –IV**  
**Chemistry (Major-I) Inorganic Chemistry**  
**BS23MJ4CH1**

**Learning Objectives :** The course introduces the students to transition elements, their properties and applications. The course also delves on topics such as coordination compounds and their structural and spectral aspects. In addition to that the course introduces students to the concepts of chemical bonding and non-aqueous solvents.

**Learning Outcomes:** By the end of the course, the students will be able to: Understand the trends, properties and application of transition elements. Discuss the various theories for structure of coordination compounds, their properties and energies. Explain the theories of chemical bonding and structures of molecules on the basis of them. Understand the concept of non-aqueous solvents and their variety of applications in chemical reactions.

**UNIT-1 Transition Elements**

General group trends with special reference to electronic configuration, colour, variable valency, magnetic properties (no temperature dependence), catalytic properties, and ability to form complexes. Latimer diagrams of Mn, Fe and Cu in acidic and basic media.

A brief discussion of differences between the first, second and third transition series. Some important compounds of Cr, Mn, Fe and Co and their roles as laboratory reagents; Potassium dichromate, potassium permanganate, potassium ferrocyanide, potassium ferricyanide, sodium nitroprusside and sodium cobaltinitrite.

**UNIT-2 Co-ordination Compounds**

Application of valence bond theory to some complexes; Shortcoming of valence bond theory; Crystal Field Theory; Orientation of d-orbitals and Crystal Field Splitting of Energy levels; Crystal Field Splitting in Octahedral complexes; Crystal Field Stabilization Energy (CFSE); Crystal Field Splitting in Tetrahedral Complexes; Crystal Field Splitting in Tetragonal and square Planar Complexes; Magnetic Properties of Metal Complexes and Crystal Field Theory; Factors influences the magnitude of Crystal Field Splitting; Color of Transition Metal Complexes; Crystal Field Effects on Ionic Radii; Crystal Field Effects on Lattice Energies; Jahn- Teller Effect.

### **UNIT- 3 Chemical Bonding**

Molecular orbital Theory; Energy Level Diagram for Molecular Orbital's; Mixing of Orbital's; Filling up of Molecular Orbital's; Electronic Configuration of Hetero nuclear Diatomic molecules and ion ( $CN^-$ , HF, HCl, ClF), Molecular orbital's of Polyatomic Species ( $BeH_2$ ,  $BH_3$ ,  $NH_3$ )(Excluding Walsh diagram); M.O. Theory of  $[Co(NH_3)_6]^{3+}$  and  $[CoF_6]^{3-}$ ; Molecular orbital or Band Theory for metals.

### **UNIT- 4 Non Aqueous Solvents Marks**

Introduction; Classification of Solvents; General Properties of Ionising Solvents

(a) Liquid Ammonia ( $NH_3$ ): Physical Properties, Auto-ionization, Acid-Base reactions, Reduction –Oxidation (Redox) reactions; Advantages and disadvantages of using liquid Ammonia as a solvent.

(b) Liquid  $SO_2$ : Physical Properties, solubility of Inorganic materials and Organic Compounds, Electrolytic conductance behavior of solutions, Acid-Base reactions, Solvolysis, Reduction –Oxidation (Redox) reactions

(c) Liquid HF: Physical Properties, Solvent effect, Amphoteric behavior, Precipitation reactions, Reduction –Oxidation (Redox) reactions, Solutions of Compounds of Biological Interest.

### **REFERENCES**

1. Gurdeep Raj, "Advanced Inorganic Chemistry", Goel Publishing House, Meerut, Volume –I, 24th Revised Edition, 1998.
2. R.D. Madan, "Modern Inorganic Chemistry", S. Chand & Co. Ltd., New Delhi, 2nd Edition, 2006.
3. J.D. Lee, "Concise Inorganic Chemistry", Wiley India Publication, 5th Edition, 1996, Reprint 2011.
4. W.V. Malik, G.D. Tuli, R.D. Madan, "Selected Topics in Inorganic Chemistry", S.Chand & Co. Ltd., New Delhi, 7th Edition, 2007.
5. A.K. Chandra, "Introductory Quantum Chemistry", Tata- McGraw Hill Pub. Co. Ltd., New Delhi, 4th Edition.
6. Puri, Sharma, Kalia, "Principles of Inorganic Chemistry", Milestone Publishers & Distributors, New Delhi, 3rd Edition, 2006.
7. R.K.Prasad, "Quantum chemistry", New Age International (P) Ltd., Publishers, 4th Edition, 2010.