St. Aloysius (Autonomous) College, Jabalpur
Department of Chemistry

MARKS SCHEME FOR BSc. III YEAR
COURSE CODE: S3CHEN3D
COURSE TYPE: INSTRUMENTAL TECHNIQUES IN CHEMISTRY DSE-Paper-1

COURSE TYPE: DSE MAJOR **SUBJECT: CHEMISTRY**
MAXIMUM MARKS: 100 **CREDIT VALUE: 4**
TOTAL MARKS:

SUBJECT	EXAMINATION	MAX. MARKS	MIN. MARKS
CHEMISTRY	CCE EXAM	30	35
	FINAL EXAM	70	

ASSISMENT AND EVALUATION

Assessment and presentation	10
Class test (Descriptive Question)	10
Assignment	10
Total	**30**

Theory Paper:

SECTION WISE MARKS DISTRIBUTION

S. No.	SECTION	TOTAL NO. OF QUESTION	MARKS
1	A	Very Short Question	5 X 2= 10
2	B	Short Answer Question	6 X 3= 18
3	C	Long Answer Question	6 X 7= 42
		Total	**70**
	Internal and ExternalMarks	**Grand Total**	**30+ 70 =100**

Class	*CourseType*	*CourseCode*	*Course Title (Theory/Practical)*	*Marks*	
B.Sc. III Year	Major	S3CHEN3D	Instrumental Techniques in Chemistry	Max: 100	Min: 35

Course Objectives:

- To enable the students in standard samples for analysis
- To enable the Instrumentation for Analytical methods of Chemistry
- To enable the students in understanding Instrumentation for various spectroscopic techniques
- To enable the Principles and instrumentation of various electro analytical techniques
- To enable the Instrumentation used in optical methods of analysis
- To enable the Advance Chromatography Techniques

UNIT – I

Practical Aspects of Chemical Analysis

(a) Analysis of real samples: Choice of analytical method, Analysis of standard samples, preparing standard samples for analysis moisture in sample, drying the analytical sample, decomposition and dissolution of sample, source of errors in decomposition and dissolution.

(b) Automation in Laboratory: Introduction, classification of analytical methods. Types of instrumental methods. Importance of instruments for analysis. Analog & Digital signals, for planning for laboratory automation. An overview of automatic instruments & instrumentation. Good laboratory practices. Instrumental standardization, optimization of procedures.

Unit- II

Electronic and Vibrational-Rotational Spectroscopy

(a) Electronic or Ultra-Violet Visible (UV-Vis) Spectroscopy: Basic principles, Instrumentation and Techniques.

(b) Fourier-transform infrared (FTIR) Spectroscopy: Introduction and basic principle of IR spectroscopy, Instrumentation. Working of FTIR Spectrophotometer, Advantages of FTIR Spectroscopy.

(c) Raman Spectroscopy: Mechanism of Raman Effect- Quantum theory and classical theory. Instrumentation and techniques. Qualitative treatment and techniques. Qualitative treatment of Rotational Raman effect, Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines, their intensity difference, rule of mutual exclusion.

Unit- III

Molecular Characterization techniques

(a) Nuclear Magnetic Response Spectroscopy: Basic principles of NMR, Instrumentation- Magnet, sweep generator, RF generator, RF receiver, signal recorder, calculation of NMR signals.

(b) Electron Spin Resonance (ESR) spectroscopy: Introduction, principle, instrumentation, selection rules, interpretation of Lande's factor 'g'. Hyperfine and super hyperfine coupling.

(c) Mass Spectrometry: Theory of mass spectrometry. Principle and operation of mass spectrometer. Ionization techniques- electron impact, chemical ionization, electrospray, electrical discharge, lase desorption, fast atom bombardment.

Separation of ions on the basis of mass-charge ratio. Analyzers- Magnetic-sector, Electric quadrupole and high-resolution multiple-reflection time of flight (MR-TOF)

Unit- IV

Atom Characterization Techniques

(a) Flame photometry: Flame emission spectroscopy, characteristics of flame, instrumentation & working of flame photometer.

(b) Atomic Absorption Spectroscopy (AAS): Basic principles, Instrumentation, atomizer, monochromator, detector, sensitivity and detection limits. Interferences in AAS and their elimination.

(c) Atomic Emission Spectroscopy (AES): Principles, Sources for excitation, Instrumentation, Qualitative and quantitive Analysis.

Unit-V

Electro analytical techniques

(a) Polarography: General principles and instrumentation of polarography half-wave potential, equations for reversible cathodic, anodic and cathodic-anodic waves , analysis of reversible polarographic wave.

(b) Voltametry: General principles and instrumentation of polarography, half-wave potential, equations for reversible polarographic wave.

(c) Amperometry: Principles and amperometric titration techniques- Dropping mercury electrodes. Instrumentation and measurement of electro motive force of cell (EMF). Potentiometric titrations.

(d) Conductometry: Principle, measurement of conductance, conductometric titrations.

Unit- VI

Optical and Advanced Chromatographic Techniques

(a) Polarimetry: Polarimeter, optical rotations, measurements of optical rotation.

(b) Refractometry: Principle of refraction, Snell's law, Construction & working of refractometer.

(c) Gas Chromatography (GC): Theory, Instrumentation-description of equipment and different parts, columns (packed and capillary columns).Detector specifications, Thermal conductivity detector, Flame ionization detector, electron capture detector, nitrogen-phosphorous detector or thermionic specific detector (TSD), photo ionization detector. Programmed temperature gas chromatography.

(d) High Performance Liquid Chromatography (HPLC): Theory, Instrumentation, description of the different parts of the equipment, stationary phases (columns), mobile phases, detectors, UV detector, refractive index (RI) detector, Fluorescence detector, Photo Diode Array detector, Evaporative Light Scattering Detector (ELSD), conductometric detector and electrometric detector.

Course Outcomes: By the end of this course student will learn the following aspects of instrumental technique in chemistry:

- Preparation of standard samples for analysis
- Instrumentation for Analytical methods of Chemistry
- Instrumentation for various spectroscopic techniques
- Principles and instrumentation of various electro analytical techniques
- Instrumentation used in optical methods of analysis
- Advance Chromatography Techniques

Reference Books:

1. Galen, e., "Instrumental methods & chemical analysis", McGraw-Hill publishing company ltd., 1985.
2. Christian, G. D., "Analytical Chemistry", John Wiley and Sons. Inc, 1944.
3. Harris, D.C., "Qualitative Chemical Analysis", W.H. Freeman & Co. New York, 2003, 7th Edition.
4. Drago, R.S., "Physical Methods in Chemistry", W.B. Saunders Co, 1977.
5. Atkins P. W., "Physical Chemistry", Oxford University Press, 2017.

Class	*Course Type*	*CourseCode*	*Course Title (Theory/Practical)*	*Marks*	
B.Sc. III Year	Major	S3CHEN3D	Instrumental Techniques in Chemistry	Max: 100	Min: 35

General Objective:

- To enable the students to create an understanding about the laboratory practices, various laboratory techniques and analysis.
- To recognize safe laboratory practices, handling laboratory glassware, equipment, and chemical reagents.
- To enable the students to operate spectrophotometer, conductometer, polarimeter and pH meter

EXTERNAL ASSESSMENT: 70 marks

Course Content:

1. Determination of concentration of Ferric ions in Ferric salicylate complex spectrophotometrically
2. Spectrophotometric determination of pK Value of an indicator.
3. Determination of Sodium and Potassium in fruit sample by flame photometer
4. Spetrophotometric determination of stoichiometric and stability of complex
5. Determination of Sulphate and phosphate by spectrophotometry
6. Determination of specific rotation of a given optically active compound by
7. Polarimetry determination of the enzyme catalyzed inversion of sucrose by polarimetry
8. Potentiometric titration of a given Strong acid solution with an NaOH solution
9. Potentiometric titration of a given Weak acid solution with an NaOH solution
10. Conductometric titration of Strong acid solution with an NaOH solution
11. Conductometric titration of a given Weak acid solution with an NaOH solution
12. pH metric- Strong acid solution with an NaOH solution
13. pH metric- Weak acid solution with an NaOH solution.

INTERNAL ASSESSMENT: **30 marks**

Internal assessment	**Marks**	**External assessment**	**Marks**
Chemical and Lab safety **Class Interaction / Quiz**	**10**	**Viva- Voce on Practical**	**10**
Attendance	**10**	**Practical Record File**	**10**
Assignment (Charts/ model seminar/ Rural services/ Technology dissemination/ Report of Excursion/ Lab visits/ Survey/ Industrial visit)	**10**	**Table work/ Experiments**	**50**
TOTAL	**30**		**70**

Course Outcomes: By the end of this course student will be able to understand

- Preparation of standard sample for analysis
- Determination of concentration of the solution by spectroscopic method
- Determination of stability constant
- Determination of potentiometric and conductometric titration
- Advanced Chromatographic technique

MARKS SCHEME FOR BSc. III YEAR

COURSE CODE: S3CHEM4D

COURSE TYPE: BIO- PHYSICAL, BIOINORGANIC AND ORGANOMETALLIC COMPOUND

COURSE TYPE: DSE MAJOR **SUBJECT: CHEMISTRY**
MAXIMUM MARKS: 100 **CREDIT VALUE: 4**
TOTAL MARKS:

SUBJECT	EXAMINATION	MAX. MARKS	MIN. MARKS
CHEMISTRY	CCE EXAM	30	35
	FINAL EXAM	70	

ASSISMENT AND EVALUATION

Assessment and presentation	10
Class test (Descriptive Question)	10
Assignment	10
Total	**30**

Theory Paper:

SECTION WISE MARKS DISTRIBUTION

S. No.	SECTION	TOTAL NO. OF QUESTION	MARKS
1	A	Very Short Question	5 X 2= 10
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		Total	**70**
	Internal and ExternalMarks	**Grand Total**	**30+ 70 =100**

Class	*CourseType*	*CourseCode*	*Course Title (Theory/Practical)*	*Marks*	
B.Sc. III Year	Major	S3CHEN4D	Bio- Physical, Bioinorganic and Organometallic compound	Max: 100	Min: 35

Course Objectives: To enable the Biophysical concept like pH, Biological oxidation, bioenergetics.

- To enable the students in understanding Magnetic properties and electronic spectra of transition metal complexes
- To enable the Structure and bonding analysis of organometallic compounds using the MO theory
- To enable the Organometallic compounds of main group elements and their structure and bonding analysis
- To enable the Bioinorganic chemistry and roll of metal ions in biological system

Unit- I

(a) Water, pH and buffer:

Water, pH and buffer water as a medium for biological reaction, concept of p in terms of biological system, effect of pH on a biomolecule, biological buffer system

Bonding in biomolecule hydrogen bond, vanderwal interaction, ionic bond hydrophobic attraction, glycoside linkages peptide bond, phosphodiester linkage role of different biological buffer system like phosphate buffer, biocarbonate buffer protein aminoacid buffer, hemoglobin buffer system

(b) Biologycal Oxidation: Definition, types of biological oxidation, reduction oxidation by direct action of oxygen, oxidation by loss of hydrogen electron transport chain, inhibitors of ETC

(c) Oxidative phosphorylation – definition, theories inhibitors of oxidative phosphorylation, un-couplers

(d) Bioenergetics – couple reaction, law of thermodynamics, free energy, relationship between standard free energy change and equilibrium constant general introduction of high energy compounds structure of ATP as universal currency of free energy in biological system with example in muscle contraction, free energy of ATP hydrolysis

Unit- II

Magnetic properties of transition metal complexes

Magnetic properties of transition metal complexes introduction, types of magnetic behaviors, diamagnetism paramagnetic, and ferromagnetism, anti-ferromagnetism, ferrimagnetism, origin and calculation of magnetism. Methods of determining magnetic susceptibility Gouy's, Bhatnagar Mathur, quincke's curie and nuclear magnetic resonance method magnetic moment, L-S coupling determination of ground state terms symbol, orbital contribution to magnetic moment and application of magnetic moment data for 3D metal complexes

Unit- III

(a) Organometalic compounds

An introduction to organometallic compounds- Definition and classification with appropriate example based on nature of metal carbon bond (ionic, s, p ,and multicenter bonds)

Metal alkyls important structural features of methyl lithium (tetramer) and trialkyl aluminum (dimer), concept of multicenter bonding in these compounds. Role of triethyl aluminum in polymerization of ethene Ziegler Natta catalyst

(b) Organomagnesium compound – Grignard's reagents preparation structure and chemical reaction

(c) Organo zinc compound- preparation and chemical reaction

(d) Organolithium compounds- preparation and chemical reaction organo sulpur compounds- nomenclature structure characteristics thio ether, sulphonics acid, sulphonamide and sulphaguanidine methods of preparation and chemical reactions

Unit- IV

Metal carbonyls

Metal carbonyls 18 electron rule, electron count of mono nuclear, polynuclear and substitute metal carbonyls of 3D series general methods of preparation (direct combination reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3D series. Structure of mono nuclear and bi nuclear carbonyl of Cr, Fe, Co and Ni using VBT. π-acceptor behaviour of CO (MO diagram of CO to be discussed) synergic effects and use of IR data to explain extent of back bonding. Zeise's salt preparation and structure, evidences of synergic effects and comparison of synergic effect with that in carbonyls.

Unit- V

Bioinorganic chemistry-

Bioinorganic chemistry metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals. Na / K-pump, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, USE of chelating agents in medicine. Iron and its application in bio-systems, Role of Mg^{2+} ions in energy production and chlorophyll. Role of Ca^{2+} in blood clotting. Hemoglobin: storage and transfer of iron

Course outcome: By the end of this course student will be able to understand

- Biophysical concept like pH, Biological oxidation, bioenergetics.
- Magnetic properties and electronic spectra of transition metal complexes
- Structure and bonding analysis of organometallic compounds using the MO theory
- Organometallic compounds of main group elements and their structure and bonding analysis
- Bioinorganic chemistry and roll of metal ions in biological system

Reference Books:

1. Vogel, A. I. Qualitative Inorganic Analysis, Longman, 1972 36.
2. Svehla, G. Vogel's Qualitative Inorganic analysis, 7th edition, Prentice Hall, 1996-03-07.
3. Huheey, J. E., Keiter, E.A. & Keiter, R. L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson, 2006.
4. Lee, J.D. Concise Inorganic Chemistry 5th Ed., John Wiley and sons 2008.
5. Sharpe, A.G. Inorganic Chemistry, 4th Indian Reprint (Pearson Education) 2005.

Class	*Course Type*	*CourseCode*	*Course Title (Theory/Practical)*	*Marks*	
B.Sc. III Year	Major	S3CHEN4D	Bio- Physical, Bioinorganic and Organometallic compound	Max: 100	Min: 35

General Objective:

- To enable the students to create an understanding about the laboratory practices, various laboratory techniques and analysis.
- To recognize safe laboratory practices, handling laboratory glassware, equipment, and chemical reagents.
- To enable the students to synthesis of complexes and organic compounds.

EXTERNAL ASSESSMENT: 70 marks

Course Content:

1. Synthesis of Ferrocene from $FeCl_3$
2. Synthesis of $K_2[Fe(C_2O_4)_3]$ Complex
3. Synthesis of Sodium trioxalato ferrate
4. Synthesis of Nitrobenzene
5. Synthesis of Cr $(C_5H_5)_2$ complex
6. Synthesis of Aceto-Fe complex
7. Synthesis of triphenyl methanol from benzoic acid using Grignard reagents
8. Determination of pH of the Bio Sample
9. To determine the sugar in cough syrup by spectrophotometer
10. Estimation of Copper by Copper Sulphate
11. Determination of Rf Value in given inorganic mixture

INTERNAL ASSESSMENT: **30 marks**

Internal assessment	**Marks**	**External assessment**	**Marks**
Chemical and Lab safety **Class Interaction / Quiz**	**10**	**Viva- Voce on Practical**	**10**
Attendance	**10**	**Practical Record File**	**10**
Assignment (Charts/ model seminar/ Rural services/ Technology dissemination/ Report of Excursion/ Lab visits/ Survey/ Industrial visit)	**10**	**Table work/ Experiments**	**50**
TOTAL	**30**		**70**

Course Outcomes: By the end of this course student will be able to understand

- How to synthesis Ferrocene from $FeCl_3$
- How to synthesis $K_2[Fe(C_2O_4)_3]$ Complex
- How to determine pH of biosample
- How to determine sugar in cough syrup by spectrophotometer

MARKS SCHEME FOR BSc. III YEAR

COURSE CODE: S3CHEM2T
COURSE TYPE: PHARMACEUTICAL AND MEDICAL CHEMISTRY

COURSE TYPE: MINOR/ ELECTIVE **SUBJECT: CHEMISTRY**
MAXIMUM MARKS: 100 **CREDIT VALUE: 4**
TOTAL MARKS:

SUBJECT	EXAMINATION	MAX. MARKS	MIN. MARKS
CHEMISTRY	CCE EXAM	30	35
	FINAL EXAM	70	

ASSISMENT AND EVALUATION

Assessment and presentation	10
Class test (Descriptive Question)	10
Assignment	10
Total	**30**

Theory Paper:

SECTION WISE MARKS DISTRIBUTION

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		Total	**70**
	Internal and ExternalMarks	**Grand Total**	**30+ 70 =100**

Class	*CourseType*	*CourseCode*	*Course Title (Theory/Practical)*	*Marks*	
B.Sc. III Year	Minor/ Elective	**S3CHEM2T**	Pharmaceutical and Medicinal Chemistry	Max: 100	Min: 35

Course Objectives:

- To enable the students importance of pharmaceutical chemistry and pharmacopeia.
- To enable the students Learn intellectual property rights, patents trademark and copyright.
- To enable the students Understand definition, classification of the drug with example and structure.
- To enable the students Describe the structure activity relation of some important class of drugs.
- To enable the students Describe the overall process of drug discovery and the role played by medicinal chemistry in this process.
- To enable the students Relate the structure and physical propertie4s of drug to their pharmacological activity.

Unit-I

Pharmaceutical Chemistry:

Introduction to Pharmacy, career in pharmacy, codes of pharmaceutical ethics, importance of pharmaceutical chemistry, pharmacopeia and its history (IP, BP, USP, NF).

Drug and cosmetic act with special reference to schedule M, GMP, GLP, GCP, USFDA, NDA, clinical trial.

Concept of quality and total quantity management, quality assurance and quality control, IPQA, IPQC. Documentation and maintenance of record, intellectual property rights, patents, trademarks, copyright, patent act.

Unit- II

Pharmacognosy:

Definition, history, scope and development of Pharmacognosy.

Classification and sources of drugs: classification of drugs, sources and use of natural drug product, biological (plants, animals and microbes), geographical, marine and mineral resources.

Drug Receptors: Introduction to drug receptors, nature of drug receptors, different bonding involved in drug receptor interaction, drug receptor theories.

Drug absorption: routes of drug administration, absorption of drug and factors affecting absorption.

Unit- III

Molecular Modeling and Drug Design:

Drug design and development an overview, analogues and prodrugs structure and activity relationship between chemical (SAR), factors governing drug design, approaches to drug design, receptor site theory, introduction to combinatorial synthesis in drug discovery, factors affecting bioactivity. QSAR-Free-Wilson analysis, structure a biological activity, Hansch Analysis, relationship between Free-Wilson analysis and Hansch analysis.

Unit- IV

Antibiotics and Anti-bacterials:

Introduction, Antibiotic β-Lactum Type- penicillin, cephalosporins, antitubercular- streptomycin, Broad Spectrum Antibiotics- Tetracyclines, Anticancer- Dactinomycin (Actinomysin D)

Unit- V

Antifungal and Non-Steroidal Anti-inflammatory Drugs:

Antifungal: Polysenes, Antibacteria-Ciprofloxacin, Norfloxacin, Antiviral-Acyclovir.
Antimalarials: Chemotherapy of Malaria SAR, Chloroquine, Chloroguanide and Mefloquine.
Non-steroidal Anti-inflammatory Drugs: Diclofenac Sodium, Ibuprofen and Netopam.

Course outcome: By the end of this course student will be able to understand

- Understand importance of pharmaceutical chemistry and pharmacopeia.
- Learn intellectual property rights, patents trademark and copyright.
- Understand definition, classification of the drug with example and structure.
- Describe the structure activity relation of some important class of drugs.
- Describe the overall process of drug discovery and the role played by medicinal chemistry in this process.
- Relate the structure and physical propertie4s of drug to their pharmacological activity.
- Explain physio-chemical properties related to QSAR.

Reference Books:

1. "Pharmaceutical Chemistry Inorganic Vol. 1", Chatwal G. R., Himalaya Publishing House, Mumbai, 2010.
2. "Textbook of Pharmacognosy", Wallis T. E., CBS Publishers and Distributers, New Delhi, 2005, Fifth Edition.
3. "Pharmaceutical Chemistry", Choudhary N. C. and Gurbani N. K., Vallabh Prakashan, New Delhi, 2009, Fifth Edition.
4. "Pharmaceutical Chemistry", Watson D.G., Churchill Livingstone Elsevier, UK, 2011.
5. "Text Book Of Professional Pharmacy". Jain N. K. and Sharma S. N., Vallabh Prakashan, New Delhi, 2009, Fifth Edition.

Class	*Course Type*	*CourseCode*	*Course Title (Theory/Practical)*	*Marks*	
B.Sc. III Year	Minor/ Elective	**S3CHEM2T**	Pharmaceutical and Medicinal Chemistry	Max: 100	Min: 35

General Objective:

- To enable the students to create an understanding about the laboratory practices, various laboratory techniques and analysis.
- To recognize safe laboratory practices, handling laboratory glassware, equipment, and chemical reagents.
- To enable the students to gain knowledge about inorganic and organic synthesis.

EXTERNAL ASSESSMENT: 70 marks

Course Content:

1. Synthesis of Acetanilide
2. Synthesis of Aspirine
3. Synthesis of tinchre Iodine
4. Synthesis of Potash Alum
5. Synthesis of Ferrous Ammonium Sulphate
6 Isolation of Caffein by tea leaves
7. Extraction of active constituent from solvent extraction method
8. Identification of crude drug
9. Morphology of turmeric, Ginger, Mentha
10. Preparation of suspension / Emulsions, Oil Mint
11. Synthesis of Milk of Magnesia
12. Preparation of simple Syrup as per IP and USP
13. Preparation of Pharmaceutical Buffer and study of its theoretical and calculated pH
14. Preparation of Zinc Oxide
15. Calcium Carbonate
16. MgCO3
17. Synthesis of Oil of Winter Green
18. Synthesis of Oxalic acid

INTERNAL ASSESSMENT: **30 marks**

Course Outcomes: By the end of this course student will be able to understand

- How to prepare Acetanilide
- How to isolate the caffeine from tea leaves
- To learn about preparation of simple syrup as per IP and USP