



Karmaveer Bhaurao Patil University, Satara

Syllabus for

B. Sc. I Chemistry

Under

Faculty of Science and Technology
(As per NEP 2020)

With effect from Academic Year 2024-2025

Syllabus for Bachelor of Science (B. Sc.) Part –I Chemistry

PREAMBLE:

This syllabus is prepared for first year undergraduate students as per NEP 2020. At this level, to develop their interest towards chemistry as basic science and also to prepare them for the academic and industrial exposure simultaneously. Introduction of instrumental techniques with the regular chemistry exercises will help to enhance analytical thinking of the students. The interdisciplinary approach with vigour and depth is compatible to the syllabi of other universities, at the same time is not rigid for the students at first year of their graduation. The units in the syllabus are well defined with scope and the number of lectures. The references are mentioned with relevance.

GENERAL OBJECTIVES OF THE COURSE:

1. To provide students with a strong foundation in the fundamental principles of Chemistry.
2. To foster a scientific mindset by encouraging students to be open-minded, analytical, critical, and inquisitive in understanding chemical phenomena.
3. To develop practical skills in conducting laboratory experiments, handling chemicals safely, and using scientific instruments effectively.
4. To help students understand chemical concepts, scientific terminology, laws, theories, reactions, and their interrelationships.
5. To create awareness about the importance of chemistry in environmental protection, sustainable development, and responsible utilization of natural resources.
6. To equip students with knowledge of chemistry and its interdisciplinary applications, enabling them to understand the role of chemistry in improving human life and the environment.
7. To empower students to apply chemical knowledge in industries, agriculture, healthcare, environmental management, and entrepreneurship, thereby promoting self-reliance.

PROGRAMME OUTCOMES:

After completing the B. Sc. program, graduates will:

1. Possess a strong foundation of knowledge in Chemistry and related scientific disciplines.
2. Develop a scientific attitude with critical thinking, analytical skills, and curiosity, enabling them to pursue research, innovation, and lifelong learning.
3. Demonstrate proficiency in laboratory techniques, experimentation, chemical analysis, and the safe handling of chemicals and instruments.
4. Be eligible to pursue higher education in Chemistry and interdisciplinary sciences in India and abroad.
5. Qualify for competitive examinations and employment opportunities in government, academic, research, and industrial sectors.
6. Meet the eligibility requirements for careers in chemical, pharmaceutical, food, environmental, forensic, agricultural, and allied industries.
7. Develop entrepreneurial skills to establish ventures related to chemical products, analytical laboratories, consultancy, and allied fields.
8. Enhance communication, teamwork, leadership, ethical values, scientific temperament, and problem-solving abilities for professional and societal development.

PROGRAM SPECIFIC OBJECTIVES:

1. To enable students to understand the fundamental concepts, principles, laws, and modern developments in Physical, Organic, Inorganic, and Analytical Chemistry.
2. To integrate practical laboratory work with theoretical knowledge, thereby strengthening the understanding of chemical concepts and experimental techniques.
3. To inspire and promote interest in Chemistry through laboratory learning, scientific inquiry, and innovative thinking.
4. To develop awareness of laboratory safety, environmental responsibility, green chemistry, and sustainable chemical practices.
5. To prepare students for higher education, research, industrial applications, and professional careers in Chemistry.

PROGRAMME SPECIFIC OUTCOMES:

After completing the B. Sc. (Chemistry) program, students will:

1. Explain, describe, interpret, and discuss fundamental concepts in Physical, Organic, Inorganic, and Analytical Chemistry.
2. Perform qualitative and quantitative chemical experiments using appropriate laboratory techniques and safety practices.
3. Analyze, interpret, and solve chemical problems using scientific reasoning and experimental evidence.
4. Apply chemical knowledge to address challenges in healthcare, agriculture, energy, environmental protection, and industrial development.
5. Demonstrate competency in handling laboratory instruments, preparing standard solutions, carrying out chemical analyses, and interpreting experimental results.
6. Design and execute small laboratory projects while maintaining scientific ethics and laboratory safety.
7. Develop practical skills relevant to chemical, pharmaceutical, food, environmental, forensic, and allied industries through laboratory training and internships.
8. Strengthen research aptitude by participating in research projects, internships, scientific investigations, and innovation activities.
9. Present scientific findings effectively through seminars, posters, project reports, conferences, and research publications.
10. Demonstrate environmental responsibility by adopting sustainable practices, green chemistry principles, and ethical approaches in professional and social life.

1. TITLE: Chemistry

2. YEAR OF IMPLEMENTATION: 2024-2025

3. DURATION: 01 year

4. PATTERN: Semester examination

5. MEDIUM OF INSTRUCTION: English

6. ELIGIBILITY OF THE STUDENTS:

Higher Secondary Certificate (HSC/10+2) examination or an equivalent examination from a recognized Board with the Science stream.

7. ELIGIBILITY OF THE CORE FACULTY:

As per the rule and regulation of the UGC and Government of Maharashtra

8. STRUCTURE OF COURSE:

Level	Semester	Course	DSC	OE	AEC/VEC/IKS	Total	Degree/Cum. Cr. MEME
4.5	I	I	DSC-I (2) DSC-II (2) DSC P-I (2)	2	IKS I (2) (Generic)	22	UG Certificate 44
		II	DSC-I (2) DSC-II (2) DSC P-I (2)				
		III	DSC-I (2) DSC-II (2) DSCP-I (2)				
4.5	II	I	DSC-I (2) DSC-II (2) DSC P-I (2)	2	VEC I (2) DEGG and IIC	22	
		II	DSC-I (2) DSC-II (2) DSC P-I (2)				
		III	DSC-I (2) DSC-II (2) DSC P-I (2)				

Note-For practical number of students per batch = 20 students.

9. COURSE TITLE:**1) FIRST SEMESTER**

Sr. No.	Course	Course Code	Title of the Course	No. of Lectures/ practical per week	Credits
1	Chemistry	BCT 111	Physical Chemistry	2	2
		BCT 112	Inorganic Chemistry	2	2
		BCP 113	Practical I (based on BCT 111 and BCT 112)	1	2
2	OE	BCPOE 1	-	1	2
3	IKS	BCTIKS 1	Introduction to Indian Knowledge System	2	2

2) SECOND SEMESTER

Sr. No.	Course	Course Code	Title of the Course	No. of Lectures/ practical per week	Credits
1	Chemistry	BCT 121	Organic Chemistry	2	2
		BCT 122	Analytical Chemistry	2	2
		BCP 123	Practical II (based on BCT 121 and BCT 122)	1	2
2	OE	BCPOE 2	-	1	2
3	VEC	BCTVEC I	Democracy, Election and Indian Constitution	2	2

10. EVALUATION STRUCTURE:**Theory**

Assessment Category	Continuous Comprehensive Evaluation (Best of two CCE Marks will be considered)				ESE	Total Marks	Credits
	CCE-I	CCE-II	CCE-III	Total			
Theory of 2 Credits	10	10	10	20	30	50	02

Practical

Assessment Category	Continuous Comprehensive Evaluation	ESE	Total Marks	Credits
	Journal/ Oral/Student performance			
Practical of 2 Credits	20	30	50	02

11. OTHER FEATURES:**LIBRARY:**

Reference books, Text books, Journals and Periodicals are available in Institute and Departmental Library. (Separate reference lists are attached along with the respective course syllabus)

EQUIPMENTS:

- Computer, LCD projector, visualizer, smart board, interactive panel.
- Laboratory Equipments: 1. Furnace 2. Hot Air Oven 3. Digital weighing balance
4. Incubator 5. pH meter 6. Refrigerator 7. Centrifuge machine 8. Ultrasonicator

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016)	
	Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Chemistry	
	Programme: B. Sc. I	Semester – I
	Type: DSC I	Marks: 50
	Credits: 2	From: A. Y. 2024-25
Name of the Course: BCT 111: Physical chemistry		
Course Objectives: Students should be able to... 1. understand the basic concepts in thermodynamics. 2. learn principle behind the chemical equilibrium. 3. recall the knowledge of rates of chemical reactions. 4. study the properties of ideal and non-ideal gases.		
Course Outcomes: By the end of the course, students will be able to... 1. relate the laws of thermodynamics with real life examples. 2. derive relationship between various equilibrium constants. 3. illustrate and derive the rate constant of various reactions. 4. differentiate between ideal and non-ideal behavior of gases.		
Module	Title and Contents	Hrs.
Module 1	Chemical Thermodynamics: 1.1 Introduction, Basic Terms 1.2 Spontaneous and non-spontaneous process with examples, Statement of Second law of Thermodynamics, Carnot's cycle, its efficiency, Carnot's Theorem (Heat engine) 1.3 Concept of entropy, physical significance of entropy. Entropy as a function of volume and temperature, pressure and temperature, entropy of mixing of gases, entropy change accompanying phase transition 1.4 Third law of thermodynamics 1.5 Numerical problems	08
Module 2	Chemical Equilibria: 2.1 Concept of free energy, Free energy change in chemical reaction 2.2 Thermodynamic derivation of law of chemical equilibrium 2.3 Distinction between ΔG and ΔG^0 , Le Chatelier's principle, conditions for maximum yield in industrial processes like manufacture of ammonia and sulphuric acid 2.4 Relationship between K_p , K_c and K_x for reactions involving ideal Gases	08
	Chemical Kinetics: 3.1 Introduction, Rate of reaction, Definition and units of rate constant, Factors affecting rate of reaction (nature of reactant,	08

Module 3	concentration, pressure, temperature and catalyst) 3.2 Order and Molecularity of reaction, Zero order reaction, First order reaction, Characteristics, Examples 3.3 Pseudo-unimolecular reactions, Examples 3.4 Second order reaction: Derivation of rate constant for equal and unequal concentration of the reactants, Characteristics, Examples 3.5 Determination of order of reaction by i) integration method ii) graphical method iii) Half-life method	
Module 4	Kinetic Theory of Gases: 4.1 Postulates of Kinetic Theory of Gases 4.2 Ideal and Non ideal gases, Deviation of real gases from ideal behaviour, Compressibility factor, causes of deviation Boyle temperature 4.3 Van der Waals equation of state for real gases. Explanation of real gas behaviour by Van der Waal's equation, 4.4 Critical Phenomena: PV-isotherms of real gases (Andrew's isotherms), Continuity of state, Critical constants and their calculation from Van der Waals equation 4.5 Most probable, average and root mean square velocities and their Temperature dependence. (no derivation), Numerical Problems	06
Reference Books: 1. Puri B. R., Sharma L. R., Pathania M. S. Principles of Physical Chemistry. Vishal Publishing Company, 2020. 2. Soni P. L., Dharmarha O. P., Dash U. N. Text Book of Physical Chemistry. Sultan Chand & Sons, New Delhi, 2011. 3. Bahl A., Bahl B. S., Tuli G. D. Essentials of Physical Chemistry. S. Chand & Company Ltd., New Delhi, 2020. 4. Rao C. N. R. University General Chemistry: An Introduction to Chemical Science. Macmillan, New Delhi, 2009.		
Evaluation Pattern (60:40)		
Total Marks: 50		
Continuous Comprehensive Evaluation (20 Marks): - CCE - I: 10 Marks: Home Assignment - CCE - II: 10 Marks: Short and long answer questions Test/Seminar/Open Book Test/Quiz/Case study/Book review/Field work/ Industry visit - CCE- III: 10 marks: Compulsory MCQ test (Note: Best of two CCE marks will be considered)	End Semester Examination (30 Marks): - Question-1: Solve the following questions (five questions of 2 marks) 10M - Question-2: Attempt any two questions (three questions of 10 marks) 20M - Question-3: Attempt any four questions (six questions of 5marks) 20M Note: Conversion of 50 marks of ESE to 30 marks	

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Chemistry	
	Programme: B. Sc. I	Semester – I
	Type: DSC II	Marks: 50
	Credits: 2	From: A. Y. 2024-25
	Name of the Course: BCT 112: Inorganic Chemistry	
Course Objectives: Students will be able to...		
1. learn basic principles and theories of atomic structure. 2. recall the concept of bonding in ionic compounds. 3. acquire the knowledge of theories of covalent compounds. 4. recite the information of bonding in homo and hetero diatomic		
Course Outcomes: By the end of the course, students should be able to...		
1. draw electronic configuration of each element on the basis of fundamental principles. 2. elucidate the structures of ionic compounds. 3. describe the various theories related to covalent bonding in inorganic compounds. 4. compare between the theories like VBT and MOT.		
Module	Title and Contents	Hrs.
Module 1	Introduction to Quantum Chemistry & Atomic Structure: 1.1 Black Body radiation, Photoelectric effect, Compton Effect 1.2 Plank’s theory, De-Broglie’s relationship 1.3 Bohr’s theory of hydrogen atom, Hydrogen spectrum 1.4 Wave theory, Heisenberg’s uncertainty principal 1.5 Atomic orbitals & Quantum numbers 1.6 Pauli’s exclusion principle, Hund’s multiplicity rule, Aufbau Principle, Electronic configuration of elements.	08
Module 2	Ionic Bonding: 2.1 Definition, General Characteristics of ionic bonding, Formation of ionic bonds 2.2 Energetics of ionic bond formation statement of Born-Lande equation for calculation of lattice energy 2.3 Born– Haber cycle & it’s applications 2.4 Fajan’s rules, Radius ratio, Radius ratio effects & calculation of radius ratio for octahedral geometry 2.5 Structure of NaCl, Rutile (TiO ₂)	07
Module 3	Covalent Bonding: 3.1 VBT approach, examples (sp to sp ³ d ³ hybridization) 3.2 Valence shell electron pair repulsion theory (VSEPR)	08

	3.3 VSEPR approach, assumptions, examples (sp to sp^3d^3 hybridization) and limitations	
Module 4	Molecular Orbital Theory (MOT): 4.1 Introduction to LCAO method 4.2 Formation of bonding, anti-bonding & non-bonding molecular orbitals 4.3 Conditions for successful overlaps 4.4 Types of overlaps, Energy level sequence for molecular orbitals when $n = 1$ & $n = 2$ 4.5 Bond order & its significance, Molecular orbital diagrams for– a. Homo nuclear diatomic molecules – He_2 , B_2 , N_2 , O_2 , O_2^+ b. Hetero nuclear diatomic molecules – CO , NO , NO^+ 4.6 Comparison between VBT & MOT	07
Reference Books: 1. Puri, B. R., Sharma, L. R. and Kalia, K. C. Principles of Inorganic Chemistry. New Delhi: Vishal Publishing Company, 2020. 2. Chanda, Manas. Atomic Structure and Chemical Bonding. New Delhi: International Publishing House Pvt. Ltd., 2019. 3. Prasad, R. K. Quantum Chemistry. New Delhi: New Age Science, 2009. 4. Huheey J. E., Keiter E. A., Keiter R. L., Medhi O. K. Inorganic Chemistry: Principles of Structure and Reactivity. Pearson Education, <i>New Delhi</i> , 2014. 5. Madan, R. D. Modern Inorganic Chemistry. New Delhi: S. Chand & Company Ltd., 1987. 6. Lee, J. D. Concise Inorganic Chemistry. 5 th ed. New Delhi: Wiley India Pvt. Ltd., 2008.		
Evaluation Pattern: (60:40)		
Total Marks: 50		
Continuous Comprehensive Evaluation (20 Marks): - CCE - I: 10 Marks: Home Assignment - CCE - II: 10 Marks: Short and long answer questions Test/Seminar/Open Book Test/Quiz/Case study/Book review/Field work/ Industry visit - CCE- III: 10 marks: Compulsory MCQ test (Note: Best of two CCE marks will be considered)		End Semester Examination (30 Marks): - Question-1: Solve the following questions (five questions of 2 marks) 10M - Question-2: Attempt any two questions (three questions of 10 marks) 20M - Question-3: Attempt any four questions (six questions of 5marks) 20M Note: Conversion of 50 marks of ESE to 30 marks

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	Faculty of Science and Technology	
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	Board of Studies in Chemistry	
	Programme: B. Sc. I	Semester – I
	Type: DSC P	Marks: 50
	Credits: 2	From: A. Y. 2024-25
Name of the Course: BCP113: Practical I (Practical Based on Course BCT 111 & 112)		
Course Objectives: Students should be able to...		
1. study the enthalpy of neutralization. 2. learn the preparation of buffer solutions. 3. study the rate of first order and second order reactions. 4. gain knowledge and analytical skills of titrimetric analysis.		
Course Outcomes: By the end of the course, students will be able to...		
1. determine the enthalpy of neutralization. 2. measure the pH of aerated drinks and buffer solutions. 3. calculate rate constant of first order and second order reaction. 4. get expertise in quantitative estimation using titrimetric method.		
Title and Contents		Hrs.
1. Determination of Enthalpy of neutralization of hydrochloric acid with sodium hydroxide. 2. Determination of heat of ionization of weak acid by using polythene bottle. 3. Preparation of Buffer solutions. Sodium Acetate –Acetic Acid and Ammonium chloride – Ammonium hydroxide. 4. Measurement of pH of buffer solution & comparison of values with theoretical values. 5. Measurement of pH of different solutions like aerated drinks and fruit juices. 6. Measurement of pH of different solutions like shampoos & soaps using pH meter. 7. Chemical Kinetics: To study the hydrolysis of methyl acetate. 8. Chemical Kinetics: To investigate the reaction between K₂S₂O₈ and KI with equal initial concentration of reactants. (Plotting of graph). 9. Equivalent weight: To determine equivalent weight of metal (Mg) by hydrogen displacement method using Eudiometer. 10. Quantitative Analysis: Gravimetric Analysis Binary Mixture NH₄Cl + BaSO₄ 11. Quantitative Analysis: Gravimetric Analysis Binary Mixture ZnO + ZnCO₃.		

12. Preparation of standard 0.1 N KMnO_4 solution and determine the strength of given oxalic acid solution. 13. Determine quantity of Fe (II) ions from the given solutions by titrating with 0.1 N $\text{K}_2\text{Cr}_2\text{O}_7$ solutions by using internal indicator. 14. Estimation of amount of Acetic acid from the given vinegar sample by titrimetric method. 15. Preparation of CuSO_4 from CuCl_2.	
Reference Books: 1. Sindhu P. S. Practical in Physical Chemistry: A Modern Approach. Macmillan Publication, New Delhi, 2006. 2. Khosla B. D., Garg V. C., Gulati A. Senior Practical Physical Chemistry. R. Chand & Co., New Delhi, 2018. 3. Athawale V. D., Mathur P. Experimental Physical Chemistry. New Age International Private Ltd., New Delhi, 2001. 4. Findlay A. Experimental Physical Chemistry. Scholar's Choice Edition. Creative Media Partners, LLC, 2015. 5. Vogel A. Vogel's Textbook of Quantitative Analysis. Longman, London, 1989. 6. Vogel A., Bassett J. A Textbook of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis. Longman, London, 1980.	
Evaluation Pattern: (60:40)	
Total Marks: 50	
Continuous Comprehensive Evaluation (20marks): • Journal: 10 Marks • Students Performance: 05 Marks • Attendance: 05 Marks	End Semester Examination (30Marks): Q.1 Major Experiment Q.2 Minor Experiment



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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Chemistry

Programme: B. Sc. I

Semester – II

Type: DSC I

Marks: 50

Credits: 2

From: A. Y. 2024-25

Name of the Course: BCT 121: Organic Chemistry

Course Objectives: Students should be able to...

1. learn the various reactive intermediates formed in chemical reactions.
2. study the different stereoisomerism phenomenon.
3. recall the knowledge of aliphatic hydrocarbons.
4. define the principles of aromaticity.

Course Outcomes: By the end of the course, students will be able to...

1. identify the structure and stability of various reactive intermediates.
2. prepare 3D-models ie. stereoisomer's of organic molecules
3. differentiate between saturated and unsaturated hydrocarbons.
4. classify the organic compounds as aromatic, anti-aromatic and non-aromatic.

Module	Title and Contents	Hrs.
Module 1	Reactive Intermediates: 1.1 Introduction, Characteristics of reactive intermediates 1.2 Carbocation-Structure, stability, preparation methods and chemical reactions 1.3 Carbanion- Structure, stability, preparation methods and chemical reactions 1.4 Carbon free radical-Structure, stability, preparation methods and chemical reactions 1.5 Carbene- Structure, stability, preparation methods and chemical reactions 1.6 Nitrene- Structure, stability, preparation methods and chemical reactions 1.7 Arynes- Structure, stability, preparation methods and chemical Reactions	08

Module 2	Stereochemistry: 2.1 Introduction, types of stereoisomerism 2.2 Elements of Symmetry, Chiral and achiral compounds 2.3 Optical isomerism in tartaric acid, 2,3-dihydroxy butanoic acid, enantiomerism and diastereomerism 2.4 Geometrical isomerism: Geometrical isomerism in aldoxime & ketoximes, configuration of aldoximes & ketoximes 2.5 Nomenclature of stereoisomerisms DL, CIP rules: R/S, E and Z (cis trans), erythro and threo	08
Module 3	Chemistry of Aliphatic Hydrocarbons 3.1 Introduction, Classification of aliphatic hydrocarbons 3.3 Alkanes: preparation methods and chemical reactions 3.3 Alkenes: Preparation methods and chemical reactions 3.4 Alkynes: Preparation methods and chemical reactions	08
Module 4	Chemistry of Aromatic Hydrocarbons: 4.1 Introduction to homocyclic and polycyclic aromatic hydrocarbons: benzene, naphthalene, anthracene 4.2 Meaning of important terms; aromatic, non aromatic, anti aromatic compounds 4.3 Huckel's rules and its applications 4.4 Aromatic electrophilic substitution reactions, effect of Substitution Groups, General mechanism of electrophilic substitution reactions 4.5 Aromatic nucleophilic substitution (addition –elimination), orientation, 4.6 Activating & deactivating groups	06
Reference Books: 1. Morrison R. T., Boyd R. N. Organic Chemistry. Prentice Hall, New Delhi, 1998. 2. Sykes P. A Guidebook to Mechanisms in Organic Chemistry. Pearson Education, New Delhi, 2003. 3. Mukharji S. M., Singh S. P., Kapoor R. P., Dass R. Organic Chemistry: As per UGC Syllabus. New Age International Publishers, New Delhi, 2017. 4. Eliel E. L., Wilen S. H. Stereochemistry of Carbon Compounds. Wiley India Edition, New Delhi, 1994. 5. Kalsi P. S. Stereochemistry: Conformation and Mechanism. New Age International Publishers, New Delhi, 2017. 6. Bansal R. K. A Textbook of Organic Chemistry. New Age International Publishers, New Delhi, 2016.		
Evaluation Pattern (60:40)		
Total Marks: 50		
Continuous Comprehensive Evaluation (20 Marks): CCE - I: 10 Marks: Home Assignment	End Semester Examination (30 Marks): Question-1: Solve the following questions (five questions of 2 marks) 10M	

• CCE - II: 10 Marks: Short and long answer questions Test/Seminar/Open Book Test/Quiz/Case study/Book review/Field work/ Industry visit • CCE- III: 10 marks: Compulsory MCQ test (Note: Best of two CCE marks will be considered)	• Question-2: Attempt any two questions (three questions of 10 marks) 20M • Question-3: Attempt any four questions (six questions of 5marks) 20M Note: Conversion of 50 marks of ESE to 30 marks
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	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Chemistry	
	Programme: B. Sc. I	Semester – II
	Type: DSC II	Marks: 50
	Credits: 2	From: A. Y. 2024-25
	Name of the Course: BCT 122: Analytical Chemistry	

Course Objectives: Students should be able to...

1. define physico-chemical principles of analytical chemistry.
2. gain knowledge of separation techniques of solids and liquids.
3. know the technical idea of separation of components from their mixtures by chromatography.
4. remember the theories behind titrimetric analysis.

Course Outcomes: By the end of the course, students will be able to...

1. explain the physico-chemical principles of basic chemical analysis.
2. purify the solid and liquid compounds by separation techniques.
3. differentiate between chromatographic techniques.
4. describe the terms involved in titrimetric analysis and sketch the titration curves.

Module	Title and Contents	Hrs.
Module 1	Introduction to Physico-chemical Principles: 1.1 Strong and weak electrolytes 1.2 Degree of Ionization, Factors affecting degree of ionization, Ionization constant and ionic product of water. Ionization of weak acids & bases, Common Ion effect 1.3 pH scale, Buffers, types of buffer 1.4 Solubility & solubility product of sparingly soluble salt 1.5 Numerical problems	08
Module 2	Purification and Separation Methods: 2.1 Distillation techniques, Distillation of liquid mixtures 2.2 Types of columns and packing, Condensers, Vacuum distillation, Spinning-band distillation, Steam distillation, Keigelrohr distillation, Isopiestic or isothermal distillation 2.3 Recrystallization Techniques	08

	2.4 Filtration, Choice of solvents, Petroleum ethers, Mixed solvents 2.5 Sublimation	
Module 3	Introduction to Chromatography: 3.1 Introduction, Basic Principle of Chromatography, Basic terms 3.2 Classification of Chromatography, Paper Chromatography- Principle, Methodology-types of papers and treatment, sample loading, choice of solvent, development-ascending, descending, circular, location of spots, determination of R_f value, Applications, Advantages and disadvantages 3.3 Thin layer chromatography; Principle, Solvent system, stationary phases, preparation of TLC plate, Detecting reagents, methodology-sample loading, development, detection of spot, R_f value, Applications, Advantages and disadvantages 3.4 Comparison of Paper Chromatography and TLC	08
Module 4	Theory of Titrimetric Analysis: 4.1 Definition of Terms: Titrand, Titrant, Equivalence Point, titration, indicator 4.2 Theory of Acid-Base Titration 4.3 Theory of Acid-Base Indicators 4.4 Titration of Strong Acid-Strong Base, Strong Acid-Weak Base, Weak Acid-Weak base with titration curves, Choice of Indicators	06
Reference Books: 1. Dahm D. J., Nelson E. A. Calculations in Chemistry. W. W. Norton & Company, New York, 2012. 2. Rao C. N. R. University General Chemistry: An Introduction to Chemical Science. Laxmi Publications, New Delhi, 2015. 3. Soni P. L., Dharmarha O. P., Dash U. N. Textbook of Physical Chemistry. Sultan Chand & Sons, New Delhi, 2011. 4. Bassett J., Denney R. C., Jeffery G. H., Mendham J. Vogel's Textbook of Quantitative Inorganic Analysis. Longman Higher Education, London, 1994. 5. Chatwal G. R., Anand S. Instrumentation Methods of Chemical Analysis. Himalaya Publishing House, Mumbai, 2016. 6. Sharma B. K. Industrial Chemistry. Goel Publishing House, Meerut, 2000.		
Evaluation Pattern: (60:40)		
Total Marks: 50		
Continuous Comprehensive Evaluation (20 Marks): • CCE - I: 10 Marks: Home Assignment • CCE - II: 10 Marks: Short and long answer questions Test/Seminar/Open Book Test/Quiz/Case study/Book review/Field work/ Industry visit		End Semester Examination (30 Marks): • Question-1: Solve the following questions (five questions of 2 marks) 10M • Question-2: Attempt any two questions (three questions of 10 marks) 20M • Question-3: Attempt any four questions (six questions of 5marks) 20M

• CCE- III: 10 marks: Compulsory MCQ test • (Note: Best of two CCE marks will be considered)	• Note: Conversion of 50 marks of ESE to 30 marks
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	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Chemistry	
	Programme: B. Sc. I	Semester – II
	Type: DSC P	Marks: 50
	Credits: 2	From: A. Y. 2024-25
	Name of the Course: Practical II: BCP 123 (Practical Based on Course BCT 121 & 122)	
Course Objectives: Students should be able to...		
1. study the volumetric estimation of compound quantitatively.		
2. determine the functional groups of molecules by qualitative analysis.		
3. gain the knowledge of preparation of derivatives of organic compounds Study the principles of chromatographic separation of elements from binary mixture.		
4. learn the purification techniques of solid and liquid compounds.		
Course Outcomes: By the end of the course, students will be able to...		
1. study the volumetric estimation of compound quantitatively.		
2. determine the functional groups of molecules by qualitative analysis.		
3. gain the knowledge of preparation of derivatives of organic compounds.		
4. study the principles of chromatographic separation of elements from binary mixture.		
Title and Contents (Any 15 of the following)		Hrs.
1. Volumetric Analysis: Estimation of Aspirin.		60
2. Estimation of Acetamide/Aniline.		
3. Organic Qualitative analysis of organic compound Benzoic acid.		
4. Organic Qualitative analysis of organic compound alpha naphthol.		
5. Organic Qualitative analysis of organic compound aniline.		
6. Organic Qualitative analysis of organic compound acetone.		
7. Organic Qualitative analysis of organic compound ethyl acetate.		
8. Organic Qualitative analysis of organic compound acetanilide.		
9. Organic Qualitative analysis of organic compound urea.		
10. Organic Qualitative analysis of organic compound thiourea.		
11. Preparations of derivatives of organic compounds		

i) Nitration ii) Oximes of aldehydes & ketones 12. Preparations of derivatives of organic compounds i) 2,4-dinitrophenylhydrazone of aldehydes & ketones ii) Picrate iii) Oxalate 13. Separation and identification of cation by paper chromatographic technique from the following mixtures i) $\text{Ni}^{2+} + \text{Cu}^{2+}$, ii) $\text{Ni}^{2+} + \text{Co}^{2+}$, iii) $\text{Cu}^{2+} + \text{Co}^{2+}$ 14. Identify & separate mixture of amino acids / sugar by paper chromatography. 15. Purification of compounds by crystallization using suitable solvents. 16. Purification of compounds by sublimation. 17. Purification of compounds by distillation.	
Reference Books: 1. Vogel A. Vogel's Textbook of Quantitative Analysis. Longman, London, 1989. 2. Vogel A., Bassett J. A Textbook of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis. Longman Scientific & Technical, London, 1980. 3. Pandey O. P., Bajpai D. N., Giri S. Practical Chemistry: For B.Sc. I, II and III Year Students of All India Universities. S. Chand & Company Ltd., New Delhi, 2010. 4. Venkateswaran V. Basic Principles of Practical Chemistry. Sultan Chand & Sons, New Delhi, 2012.	
Evaluation Pattern: (60:40)	
Total Marks: 50	
Continuous Comprehensive Evaluation (20 Marks): • Journal: 10 Marks • Students Performance: 05 Marks • Attendance: 05 Marks	End Semester Examination (30 Marks): Q.1 Major Experiment Q.2 Minor Experiment