Dissemination of Education for Knowledge, Science and Culture"
-Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College, Kolhapur (Empowered Autonomous)

DEPARTMENT OF CHEMISTRY

B. Sc. Part – II Chemistry (NEP Phase I) Major (DSC)
Semester-III & IV

SYLLABUS

Under Choice Based Credit System

to be implemented from Academic Year 2024 - 25

VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)
Department of Chemistry

Program Outcomes (POs):

PO1:Disciplinary Knowledge: Graduates will gain in-depth understanding in their specific major or discipline, mastering the foundational principles and theories, as well as advanced concepts.Execute strong theoretical and practical understanding developed from the specific programme in the area of work.

PO2:Problem-Solving Skills: Graduates will learn to use their knowledge to identify, analyze, and solve problems related to their field of study.

PO3:Analytical Skills: Graduates will gain the ability to collect, analyze, interpret, and apply data in a variety of contexts. They might also learn to use specialized software or equipment.

PO4:Research Skills and Scientific temper: Depending on the field, graduates might learn how to design and conduct experiments or studies, analyze results, and draw conclusions. They might also learn to review and understand academic literature.

PO5:Communication Skills: Many programs emphasize the ability to communicate effectively, both orally and in writing. Graduates may learn to present complex information clearly and succinctly, write detailed reports, and collaborate effectively with others.

PO6:Ethics and Professionalism: Graduates may learn about the ethical and professional standards in their field, and how to apply them in real-world situations.

B.Sc. in Chemistry

Program Specific Outcomes (PSOs):

After successful completion of degree program in Chemistry a student should be able to;

PSO1: Understand fundamental facts and concepts in Chemistry as well as its applications so as to develop interest in the study of chemistry as a discipline.

PSO2: Develop the ability to apply the principles of Chemistry in practical.

PSO3: Acquire skills of different analytical techniques used in chemistry.

PSO4: Develop Skills to evaluate, analyze and interpret the chemical reactions by using various techniques.

PSO5: Acquire knowledge and skills required to hire in any sector related to

chemistry as well as to admit for higher education.

VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)
Department of Chemistry
(2024-25 for NEP Phase-I)
Teaching and Evaluation Scheme
Three/Four- Years UG Programme
Department/Subject Specific Core or Major (DSC) as per NEP-2020
B.Sc. II, Semester- III &IV

Sr. No.	Course Abbr.	Coursecode	CourseName	Teaching SchemeHours/week		ExaminationSchemeand Marks				Course Credits
				TH	PR	SEE	CIE	PR	Marks	
Semester -III										
1	DSC-V	DSC03CHE31	Physical Chemistry	2	-	40	10	-	50	2
2	DSC-VI	DSC03 CHE 32	Analytical Chemistry	2	-	40	10	-	50	2
3	MIN-V	MIN03 CHE 31	General Aspects in Physical Chemistry	2	-	40	10	-	50	2
4	MIN-VI	MIN03 CHE 32	General Aspects in Analytical Chemistry	2	-	40	10	-	50	2
5	VSC-PR-II	VSC03CHE 39	Laboratory Techniques in Chemistry	-	4	-	-	25	25	2
6	DSC-PR-III	DSC03CHE 39	DSC- Chemistry Lab-3	-	8	-	-	50	50	4
7	MIN-PR-III	MIN03CHE 39	MIN-ChemistryLab-3	-	4	-	-	25	25	2
Semester–IIITotal				**8**	**16**	**160**	**40**	**100**	**300**	**16**
Semester-IV										
1	DSC-VII	DSC03 CHE 41	Inorganic Chemistry	2	-	40	10	-	50	2
2	DSC-VIII	DSC03 CHE 42	Organic Chemistry	2	-	40	10	-	50	2
3	MIN-VII	MIN03 CHE 41	General Aspects in Inorganic Chemistry	2	-	40	10	-	50	2
4	MIN-VIII	MIN03 CHE 42	General Aspects in Organic Chemistry	2	-	40	10	-	50	2
5	VSC-PR-III	VSC03 CHE 49	Analysis of Commercial Samples	-	4	-	-	25	25	2
6	DSC-PR-IV	DSC03 CHE 49	DSC- ChemistryLab-4	-	8	-	-	50	50	4
7	MIN-PR-IV	MIN03 CHE 49	MIN- ChemistryLab-4	-	4	-	-	25	25	2
Semester–IVTotal				**8**	**16**	**160**	**40**	**100**	**300**	**16**

B. Sc. II Sem-III (Chemistry)

Vivekanand College, Kolhapur (Empowered Autonomous)
B. Sc. Part – II Semester - III CHEMISTRY (Major)
DSC-V: DSC03CHE31: PHYSICAL CHEMISTRY
Theory: 30 hrs.
(30 Periods) Credits- 02

CO No.	On completion of the course, student will be able to:
CO1	Learn and coherent understanding of behavior of gases, ideal gas as model system and its extension to real gases. The dependence of physical state on P, V and T.
CO2	Knowledge and coherent understanding of basic concepts in thermodynamics and concept of Entropy will be gained by the student.
CO3	Learnand understanding the knowledge aboutbasic concepts in kinetics and third order reactionwith characteristics, suitable examples, and methodsfor determination of order of reactions, theories of reaction of rate andnumerical problems.
CO4	Learn and coherent understanding of conductivity and transport number of the aqueous solutions with different applications. Experimental determination of transport number and numerical problems.

Unit-I:	**Kinetic theory of Gases** 1.1 Introduction, States of matter and their properties. A) Gaseous state: 1.2 Postulates or assumptions of Kinetic Theory of Gases and derivation of the kinetic gas equation. 1.3 Ideal and Non ideal gases, Deviation of real gases from ideal behavior (from Gas Law), compressibility factor, causes of deviation from Gas Law. 1.4 Van der Waals equation of state for real gases. Explanation of real gas behavior by Van der Waal's equation, Boyle temperature (derivation not required). 1.5 Critical Phenomena: PV-isotherms of real gases (Andrew's isotherms), Continuity of state, Critical constants and their calculation from Vander Waals equation. 1.6 Maxwell- Boltzmann Distribution laws of molecular velocities	**[8]**

	and energies. 1.7 Numerical problems	
Unit-II:	**Thermodynamics** 1.1 Introduction, first and second law of thermodynamics, Concept of Entropy: Definition, mathematical expression, unit, spontaneity criteria for change in entropy. 1.2 Physical significance of Entropy. 1.3 Entropy changes for reversible and irreversible processes in isolated systems. 1.5 Entropy change in mixing of gases. 1.6 Introduction of Concept of Enthalpy and Internal energy, Integral and differential enthalpy of solution. 1.7 Variation of Enthalpy of reaction with temperature (Kirchhoff's equation) 1.8 Third law of thermodynamics, standard entropy, application of third law ofthermodynamics in determination of absolute entropy, Entropy changes in chemicalreactions 1.9 Numerical problems.	**[8]**
Unit-III:	**Chemical Kinetics** 2.1 Introduction- order of reaction. 2.2 Third order reactions: derivation of rate constant considering reaction with Equalinitial concentration, characteristics, and examples of third order reaction. 2.3 Determination of order of reaction by: i) Integration method, ii) Graphical methodiii) Half-life method. 2.4 Effect of temperature on rate of reaction, Arrhenius equation. Concept of energyof activation. 2.5 Theories of reaction rate:Collision theory for bimolecular gaseous reaction, Activated Complex Theory, 2.6 Numerical problems**.**	**[7]**
Unit-IV:	**Electrochemistry II** 4.1 IntroductionConductance of electrolyte solution, Migration of ions. 4.2 Kohlrausch law of independent migration of ions and its	**[7]**

	applications such asrelations between ionic conductance, ionic mobility and transport number, determination of equivalent conductance at infinite dilution of weak electrolytes,determination of degree of ionization of weak electrolyte, solubility and solubilityproducts of sparingly soluble salts. 4.3 Transference number, Hittorf's rule, determination of transport number usingHittorf's method and moving boundary method, factors affecting transport number:nature of electrolyte, concentration, temperature, complex formation and degree ofhydration. 4.4 Conductometric titrations – A) Acid -base titrations with mixture of strong andweak acid - a) strong acid and strong base b) weak acid and weak base B)Precipitation titration. 4.5 Advantages of conductometric titrations.	

Reference Books:

1) Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).

2) Castellan G.W. Physical Chemistry 4thEd. Narosa (2004).

3) Kotz, J.C. Treichel, P.M.& Townsend,J.R.General Chemistry, Cengage Learning IndiaPvt Ltd: New Delhi (2009).

4) Mahan,B.H. University Chemistry, 3rd Ed. Narosa (1998).

5) Petrucci, R.H. General Chemistry, 5th Ed., Macmillan Publishing Co,: New York(1985).

6) Elements of Physical Chemistry, S., Glasstone, D. Lewis.(2010)

7) Principles of physical Chemistry, Marron and Prutton. (2007).

8) Elements of Physical Chemistry, P.W.Atkins (2017-18)

9) Essentials of Physical Chemistry, Bahl and Tuli. S. Chand, 2010.

10) Physical Chemistry, Danials and Alberty (2016)

11) University General Chemistry C.N.R.Rao (2016)

12) Principals of Physical Chemistry Puri, Sharma and Pathania 47thEdition,VishalPublishing Co. Daryaganj Delhi. 110002 (2017-18)

13) Physical Chemistry A.J.Mee.(2015)

14) Advanced Physical Chemistry Gurudeep Raj (2017-18)

15) Physical Chemistry R.A.Aleberty. (2017-18)

Vivekanand College, (Empowered Autonomous)
B. Sc. II, Semester-IIICHEMISTRY (Major)
DSC-VI,DSC03CHE32: Analytical Chemistry
Theory: 30hrs (30Periods) Credits- 02

Course Outcomes: After the completion of the course, the student will be able to:

CO1: Acquire skills of instrumental and non-instrumental analytical techniques.

CO2: Understand basics of industrial manufacturing processes.

CO3: Understand basics of quantitative semi -micro analysis technique

CO4: Understand basics of industrial unit operation

Unit 1:	**Gravimetric Analysis** General introduction, Common ion effect and solubility product principles, Conditions for good precipitation, Factors affecting to precipitation like pH, temperature, nature of solvent; Super saturation and precipitate formation, Precipitation from homogeneous solution and examples, Co-precipitation, post-precipitation and remedies for their minimization, Digestion, Washing of precipitate and ignition of precipitate, Brief idea about method of filtration and drying of precipitate, Organic Precipitants.	**(8L)**
Unit 2:	**Conductometric Analysis** Introduction, Conductometric Titrations: Basic principles, experimental set up titration curves in the titration of (i) strong acid vs, strong base, (ii) weak acid vs, strong base, (iii) weak acid vs, weak base, (iv) Mixture of strong and weak acid/strong weak base vs, strong base/weak base or strong acid/weak acid, (v) sodium chloride vs, silver nitrate (vi) barium hydroxide vs, magnesium sulphate advantages and limitations.	**(7L)**
Unit 3:	**Inorganic Semi-Micro Qualitative Analysis** Theoretical principles involved in qualitative analysis, Applications of solubility product and common ion effect in separation of cations into groups, Application of complex formation in a) Separation of II group into IIA and IIB sub-groups. b) Separation of Copper from Cadmium. c) Separation of Cobalt from Nickel. d) Separation of Cl^-, Br^-, I^-. e) Detection of NO_2^-, NO_3^- (Brown ring test), Application of oxidation and reduction in a) Separation of Cl^-, Br^-, I^- in mixture b) Separation of NO_2^-	**(8L)**

	and NO_3^- in mixture, Spot test analysis.	
Unit 4:	**Unit Operations** Introduction, Meaning of unit operations and processes & its types, Principle, applications & Brief study of various unit operations such as Distillation, Extraction, Crystallization, Evaporation, Drying, Filtration.	**(7L)**

Reference Books:

1) Environmental chemistry by A. K. De
2) Modern Analytical Chemistry by David Harvey, McGRAW-Hill International Edition, 2000
3) Industrial chemistry by B.K. Sharma, GMajor Publishing Housing, 16th edition 2011
4) Analytical chemistry by B.K. Sharma, Krishna Prakashan Media Ltd, Meerut, edition 3rd 2011
5) Lee, J. D. Concise Inorganic Chemistry, (ELBS, 5th Edition)
6) Puri, Sharma and Kalia; Principles of Inorganic Chemistry, Vallabh Publication, Pitampur Delhi.

Vivekanand College, Kolhapur (Empowered Autonomous)
B. Sc. Part – II Semester - III CHEMISTRY (Minor)
MIN-V: MIN03CHE31: General Aspects in Physical Chemistry
Theory: 30 hrs.
(30Periods) Credits- 02

CO No.	On completion of the course, student will be able to:
CO1	Learn and coherent understanding of behavior of gases, ideal gas as model system and its extension to real gases. The dependence of physical state on P, V and T.
CO2	Knowledge and coherent understanding of basic concepts in thermodynamics and concept of Entropy will be gained by the student.
CO3	Learnand understanding the knowledge aboutbasic concepts in kinetics and third order reactionwith characteristics, suitable examples, and methodsfor determination of order of reactions, theories of reaction of rate andnumerical problems.
CO4	Learn and coherent understanding of conductivity and transport number of the aqueous solutions with different applications. Experimental determination of transport number and numerical problems.

Unit-I:	**Kinetic theory of Gases** 1.1 Introduction, States of matter and their properties. A) Gaseous state: 1.2 Postulates or assumptions of Kinetic Theory of Gases and derivation of the kinetic gas equation. 1.3 Ideal and Non ideal gases, Deviation of real gases from ideal behavior (from Gas Law), compressibility factor, causes of deviation from Gas Law. 1.4 Van der Waals equation of state for real gases. Explanation of real gas behavior by Van der Waal's equation, Boyle temperature (derivation not required). 1.5 Critical Phenomena: PV-isotherms of real gases (Andrew's isotherms), Continuity of state, Critical constants and their calculation from Vander Waals equation. 1.6 Maxwell- Boltzmann Distribution laws of molecular velocities	**[8]**

	and energies. 1.7 Numerical problems	
Unit-II:	**Thermodynamics** 1.1 Introduction, first and second law of thermodynamics, Concept of Entropy: Definition, mathematical expression, unit, spontaneity criteria for change in entropy. 1.2 Physical significance of Entropy. 1.3 Entropy changes for reversible and irreversible processes in isolated systems. 1.5 Entropy change in mixing of gases. 1.6 Introduction of Concept of Enthalpy and Internal energy, Integral and differential enthalpy of solution. 1.7 Variation of Enthalpy of reaction with temperature (Kirchhoff's equation) 1.8 Third law of thermodynamics, standard entropy, application of third law ofthermodynamics in determination of absolute entropy, Entropy changes in chemicalreactions 1.9 Numerical problems.	**[8]**
Unit-III:	**Chemical Kinetics** 2.1 Introduction- order of reaction. 2.2 Third order reactions: derivation of rate constant considering reaction with Equalinitial concentration, characteristics, and examples of third order reaction. 2.3 Determination of order of reaction by: i) Integration method, ii) Graphical methodiii) Half-life method. 2.4 Effect of temperature on rate of reaction, Arrhenius equation. Concept of energyof activation. 2.5 Theories of reaction rate:- Collision theory for bimolecular gaseous reaction, Activated Complex Theory, 2.6 Numerical problems**.**	**[7]**
Unit-IV:	**Electrochemistry II** 4.1 Introduction Conductance of electrolyte solution, Migration of ions. 4.2 Kohlrausch law of independent migration of ions and its	**[7]**

	applications such asrelations between ionic conductance, ionic mobility and transport number, determination of equivalent conductance at infinite dilution of weak electrolytes,determination of degree of ionization of weak electrolyte, solubility and solubilityproducts of sparingly soluble salts. 4.3 Transference number, determination of transport number usingmoving boundary method, factors affecting transport number:nature of electrolyte, concentration, temperature, complex formation and degree ofhydration. 4.5 Conductometric titrations – A) Acid -base titrations with mixture of strong andweak acid - a) strong acid and strong base b) weak acid and weak base B) Precipitation titration. 4.6 Advantages of conductometric titrations.	

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10) Physical Chemistry, Danials and Alberty (2016)

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13) Physical Chemistry A.J.Mee.(2015)

14) Advanced Physical Chemistry Gurudeep Raj (2017-18)

15) Physical Chemistry R.A.Aleberty. (2017-18)

Vivekanand College, (Empowered Autonomous)

B.Sc. II, Semester-III CHEMISTRY (Minor)

MIN VI: MIN03CHE32: General Aspects in Analytical Chemistry

Theory: 30hrs (30Periods) Credits- 02

Course Outcomes: After the completion of the course, the student will be able to:

CO1: Acquire skills of instrumental and non-instrumental analytical techniques.

CO2: Understand basics of industrial manufacturing processes.

CO3: Understand basics of quantitative semi-micro analysis technique

CO4: Understand basics of industrial unit operation

Unit 1:	**Gravimetric Analysis** General introduction, principles, Conditions for good precipitation, Factors affecting to precipitation like pH, temperature, nature of solvent; Super saturation and precipitate formation, Precipitation from homogeneous solution, Co-precipitation, post-precipitation and remedies for their minimization, Digestion, Washing of precipitate and ignition of precipitate.	**(8L)**
Unit 2:	**Conductometric Analysis** Introduction, Conductometric Titrations: Basic principles, experimental set up titration curves in the titration of (i) strong acid vs, strong base, (ii) weak acid vs, strong base, (iii) weak acid vs, weak base, (iv) Mixture of strong and weak acid/strong weak base vs, strong base/weak base or strong acid/weak acid.	**(7L)**
Unit 3:	**Inorganic Semi-Micro Qualitative Analysis** Theoretical principles involved in qualitative analysis, Applications of solubility product and common ion effect in separation of cations into groups, Application of complex formation in a) Separation of II group into IIA and IIB sub-groups. b) Separation of Copper from Cadmium. c) Separation of Cobalt from Nickel. d) Separation of Cl^-, Br^-, I^-	**(8L)**
Unit 4:	**Unit Operations** Introduction, Meaning of unit operations and processes & its types, Principle, applications & Brief study of various unit operations such as Distillation, Crystallization.	**(7L)**

Reference Books:

1) Environmental chemistry by A. K. De
2) Modern Analytical Chemistry by David Harvey, McGRAW-Hill International Edition, 2000
3) Industrial chemistry by B.K. Sharma, GMajor Publishing Housing, 16th edition 2011
4) Analytical chemistry by B.K. Sharma, Krishna Prakashan Media Ltd, Meerut, edition 3rd 2011
5) Lee, J. D. Concise Inorganic Chemistry, (ELBS, 5th Edition)
6) Puri, Sharma and Kalia; Principles of Inorganic Chemistry, Vallabh Publication, Pitampur Delhi

Vivekanand College, Kolhapur (Empowered Autonomous)

B.Sc. II, Semester-III

VSC-PR-II: VSC03CHE39: Laboratory Techniques in Chemistry

Practical: Four hours week per batch

Marks: 25 (Credits: 02)

Sr. No.	Title of the Experiment
1.	Calibrations of glasswares in the Laboratory
2.	Standardization of instruments: pH meter, Conductometer, Potentiometer
3.	Extraction Technique (Sample-Caffeine)
4.	Thin Layer Chromatography (Two Samples)
5.	Separation & Purification of following mixture Solid-Solid (1 mixture) Purification technique: Recrystallization
6.	Separation & Purification of following mixture Solid-Liquid (1 mixture) Purification technique: Recrystallization & Distillation
7.	Separation & Purification of following mixture Liquid-Liquid (1 mixture) Purification technique: Distillation
8.	Preparation & quality check of distilled water & Conductivity water
9.	Column Chromatography (1 mixture)
10.	Preparation of standard solutions of various types of concentrations such as normal, molar, ppm & percentage solution (1 solution of each concentration)
11.	Separation of liquids by Steam Distillation
12.	Separation of liquids by Vaccum Distillation
13.	Methods of Green Synthesis such as grinding, microwave synthesis or ultrasonic (any one)
14.	Computer tools in chemistry (Chemdraw)
15.	Cutting, Bending, drawing out jet of glass tube

Vivekanand College, Kolhapur (Empowered Autonomous)

B.Sc. II, Semester-III

DSC- PR-III: DSC03CHE39: DSC CHEMISTRY LAB-3

Practical: Eight hours week per batch

Marks: 50 (Credits: 04)

Chemistry

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1. Determinationofthesurfacetensionofaliquidoradilutesolutionusing Stalagmometer.
2. Studyofthevariationofsurfacetensionofadetergentsolutionwithconcentration.
3. Determinationoftherelativeandabsolute viscosity ofa liquid ofdilutesolutionusingan Ostwald'sviscometer.
4. To study the effect of acid strength on hydrolysis of an ester using 0.5 M HCl and 0.25 M HCl
5. Toinvestigatethereactionbetweenpotassiumpersulphate and KI (Equal Concentration)
6. Toinvestigatethereactionbetweenpotassiumpersulphate and KI (Unequal Concentratio n)
7. Tostudythehydrolysisofmethylacetateinpresence of HCl and H_2SO_4 and todetermine relative strength.
8. To determine temperature coefficient of a given second order reaction.
9. Todeterminethenormality ofgivenstrongacidbytitratingitagainststrongbase Conductometrically.
10. TodetermineCellConstantofthegivenConductivitycellandtoverifyOstwalddilutionlaw usingaceticacidSolutionConductometrically.
11. Todeterminethenormalityofgivenweakacidbytitratingitagainststrong base Conductometrically.
12. Determination of solubility and solubility product of sparingly soluble salt by conductance measurements.
13. Todeterminethenormality ofgivenstrongacidbytitratingitagainststrongbase Potentiometrically.
14. To determine the specific and molar refractions of benzene, toluene and xylene by Abbe's refractometer and hence to determine the refraction of –CH2 group (Methylene group) (Densities should be determined by students).
15. To determine the specific rotation and unknown concentration of sugar solution polarimetry.
16. Todetermine the unknown concentration of given coloured compounds ($KMnO_4$) Colorimetrically.
17. To determine the unknown concentration of given coloured compounds ($CuSO_4$) Colorimetrically.

18. Determination of indicator constant of a phenolphthalein indicator by colorimetry.
19. Analysis of saline sample potentiometrically
20. Determination of heat of neutralization by calorimetry method.
21. Determination of partition coefficient of iodine between water and carbon tetra chloride.
22. pH measurements: Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
23. Spectrophotometric determination of caffein and benzoic acid in soft drink.
24. **Semi-micro qualitative analysis** using mixtures –not more than four ionic species(Six anions and six cations and excluding insoluble salts.) Out of the above following:

    Cations:NH_4,Cu,Cd, Al3+, Co2+, Cr3+, Ni2+, Mn2+, Zn2+, Ba2+, Sr2+, Ca2+, K+, Mg+.
25. **Gravimetry:**Estimate the amount of metal present in a given solution gravimetrically. (Any four)
    a) Ni as Ni-DMG
    b) Ba as $BaSO_4$
    c) Fe as $Fe(OH)_3$
    d) Al as Al oxalate

Reference Books:

1) Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009
2) Khosla, B. D.; Garg, V. C. and Gulati, A. *Senior Practical Physical Chemistry*, S. Chand & Company, New Delhi, 2011.
3) Nadkarni, Kothari and Lavande *Practical Book of Physical Chemistry*
4) Findley A., *Experimental Physical Chemistry*
5) Das, R. C., B, Behra, *Experimens in Physical Chemistry*
6) Yadav J. B. *Advance Practical Physical Chemistry*
7) Khopkar, S. M., *Basic Concepts in Analytical Chemistry*

Vivekanand College, Kolhapur (Empowered Autonomous)

B.Sc. II, Semester-III

MIN-PR-III: MIN03CHE39: MIN CHEMISTRY LAB-3

Practical: Four hours week per batch

Marks: 25 (Credits: 02)

Physical and Analytical Chemistry

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1. Determinationoftherelativeandabsolute viscosity ofa liquid ofdilutesolutionusingan Ostwald'sviscometer.
2. To study the effect of acid strength on hydrolysis of an ester using 0.5 M HCl and 0.25 M HCl
3. ToinvestigatethereactionbetweenpotassiumpersulphateandKI(EqualConcentration)
4. To investigate the reaction between potassium persulphate and KI (Unequal Concentration)
5. To study the hydrolysis of methyl acetate in presence of HCl and H_2SO_4 and to determine relative strength.
6. To determine temperature coefficient of a given second order reaction.
7. To determine the normality of given strong acid by titrating it against strong base Conductometrically.
8. To determine Cell Constant of the given Conductivity cell and to verify Ostwald dilution law using acetic acid solution Conductometrically.
9. To determine the normality of given weak acidby titrating it against strong base Conductometrically.
10. To determine the normality of given strong acid by titrating it against strong base Potentiometrically.
11. **Semi-micro qualitative analysis using mixtures** –not more than **three ionic species**(4 anions and 4 cations and excluding insoluble salts) out of the following:

    Cations:NH_4,Cu^{2+},Cd, Al^{3+}, Co^{2+}, Cr^{3+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, K^{+}, Mg^{+}.
12. **Gravimetry:**Estimate the amount of metal present in a given solution gravimetrically. (Any two)

    a) Ni as Ni-DMG
    b) Ba as $BaSO_4$
    c) Fe as $Fe(OH)_3$

d) Al as Al oxalate

Reference Books:

1) Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009
2) Khosla, B. D.; Garg, V. C. and Gulati, A. *Senior Practical Physical Chemistry*, S. Chand & Company, New Delhi, 2011.
3) Nadkarni, Kothari and Lavande *Practical Book of Physical Chemistry*
4) Findley A., *Experimental Physical Chemistry*
5) Das, R. C., B, Behra, *Experimens in Physical Chemistry*
6) Yadav J. B. *Advance Practical Physical Chemistry*
7) Khopkar, S. M., *Basic Concepts in Analytical Chemistry*

Seat No.	

Ques. paper code	

VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)

B.Sc. Part- II (Chemistry) (Semester-III) Examination……..

Course Code and Name: DSC03CHEM31: Physical Chemistry

Day: Time: 2 hours

Date: --/--/---- Marks : 40

Instructions:

1) All the questions are compulsory.

2) Figures to the right indicate full marks.

3) Draw neat labelled diagrams wherever necessary.

4) Use of log table/calculator is allowed.

Q. 1. Select correct alternative(One mark each): [8]

i) Xyzabcdefghijklmnop ----------

a) -------- b) -------- c) -------- d) --------

ii) Xyzabcdefghijklmnop ----------

a) -------- b) -------- c) -------- d) --------

iii) Xyzabcdefghijklmnop ----------

a) -------- b) -------- c) -------- d) --------

iv) Xyzabcdefghijklmnop ----------

a) -------- b) -------- c) -------- d) --------

v) Xyzabcdefghijklmnop ----------

a) -------- b) -------- c) -------- d) --------

vi) Xyzabcdefghijklmnop ----------

a) -------- b) -------- c) -------- d) --------

vii) Xyzabcdefghijklmnop ----------

a) -------- b) -------- c) -------- d) --------

viii) Xyzabcdefghijklmnop ----------

a) -------- b) -------- c) -------- d) --------

Q.2. Attempt any TWO (Eight marks each Attempt any TWO out of THREE**): [16]**

i) Xyzabcdefghijklmnop.

ii) Xyzabcdefghijklmnop.

iii) Xyzabcdefghijklmnop.

Q.3. Attempt any FOUR (Four marks each Attempt any **FOUR** out of six**): [16]**

i) Xyzabcdefghijklmnop.

ii) Xyzabcdefghijklmnop.

iii) Xyzabcdefghijklmnop.

iv) Xyzabcdefghijklmnop.

v) Xyzabcdefghijklmnop.

vi) Xyzabcdefghijklmnop

B.Sc. II, Sem-IV (Chemistry)

Vivekanand College, Kolhapur (Empowered Autonomous)
B. Sc. Part – II Semester - IV CHEMISTRY (Major)
DSC-VII: DSC03CHE41: INORGANIC CHEMISTRY
Theory: 30 hrs
Marks-50 (Credits: 02)

Course Outcomes: After the completion of the course the student will be able to:

CO1: Gain the knowledge aboutproperties ofd-block elements and applications of metal chelatesin Analytical chemistry.

CO2 : Develop the basics concepts and valence bond theory of co-ordination compounds.

CO3: Learn types of various isomerisms in inorganic complexes.

CO4: Understand the basics concepts and crystal field theory of co-ordination compounds.

Unit 1:	**A] Transition Elements (3d series)** General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties and ability to form complexes. **B] Chelation** A brief introduction with respect to ligands, chelating agent, chelation and metal chelates, Structural requirements of chelate formation, Difference between metal chelate and metal complex, Classification of chelating agents (with specific illustration of bidentate chelating agents), Application of chelation with respect to chelating agents – EDTA.	**8Hrs**
Unit 2:	**Valence Bond Theory** Definition and formation of co-ordinate covalent bond in BF_3-NH_3 and $[NH_4]$*, Distinguish between double salt and complex salt, Werner's theory i) Postulates, ii) theory as applied to cobalt amines complexes; Description of the terms: ligands, co-ordination compounds, Coordination number; IUPAC system of nomenclature, Structural and stereoisomerism in complexes with coordination numbers 4 and 6.	**8Hrs**

Unit 3:	**Isomerism in Inorganic Complexes** Geometrical isomerism, Optical isomerism, structural isomerism- Ionization isomerism, hydrate isomerism, coordination isomerism, linkage isomerism and co-ordination position isomerism, postulates of VBT, Inner and outer orbital complexes w. r .t. coordination numbers 4 and 6; Drawbacks of VBT.	**7Hrs**
Unit 4:	**Crystal Field Theory** Assumptions of CFT, Crystal field splitting of 'd' orbital in octahedral, tetrahedral and square planar complex, Crystal field stabilization energy (CFSE), Comparison of CFSE for *Oh* and *Td* complexes, Crystal field effects for weak and strong fields ligands, Tetrahedral symmetry, Factors affecting the Magnitude of 10 Dq, Spectrochemical series, Jahn-Teller distortion, Limitations of CFT.	**7Hrs**

Reference Books:

1. Cotton, F. A. & Wilkinson, G. Basic Inorganic Chemistry, Wiley.
2. Shriver, D. F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.
3. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.
4. Rodgers, G. E. Inorganic & Solid State Chemistry, Cengage Learning India Ltd., 2008.
5. Lee, J. D. Concise Inorganic Chemistry, (ELBS, 5th Edition)
6. Puri, Sharma and Kalia; Principles of Inorganic Chemistry, Vallabh Publication, Pitampur Delhi.
7. Gopalan R. and Ramalingam V.; Concise Coordination Chemistry, Vikas Publishing House Pvt. Ltd.

Vivekanand College, Kolhapur (Empowered Autonomous)
B. Sc. Part – II Semester - IV CHEMISTRY (Major)
DSC-VIII: DSC03CHE42: ORGANIC CHEMISTRY
Theory: 30 hrs
Marks-50 (Credits: 02)

CO1: Get knowledge about different types of carboxylic acids, their preparation methods and chemical properties.

CO2: Know about Biomolecules like Amino acids and proteins, their different structures and functions.

CO3: Know the method of synthesis of dyes which is industrially important strategy involving the amines and diazonium salts.

CO4: Grasp knowledge about another biomolecue carbohydrate, their classification, structures and other phenomenons taking place in this macromolecule.

Unit I:	**Carboxylic acids and their derivatives** **A] Carboxylic acids (aliphatic and aromatic)** ***Preparation:*** Acidic and Alkaline hydrolysis of esters. Carboxylation of Grignard reagent ***Reactions:*** Schimdt reaction. **B] Carboxylic acid derivatives (aliphatic):** (Upto 5 carbons) ***Preparation:*** Acid halides, Anhydrides, Amides from acids and their interconversion ***Reactions:*** Esterification reaction with mechanism. Comparative study of nucleophilicity of acyl and aryl derivatives; Reformatsky Reaction, Perkin condensation and Wolf rearrangement reaction with mechanism and their applications.	**(7L)**
Unit II:	**Amines and Diazonium Salts** A)Amines: Aliphatic and Aromatic Amines (Upto 5 carbons) ***Preparation*:** From alkyl halides, alkyl nitriles, Gabriel's Phthalimide synthesis, Hofmann Bromamide Reaction. ***Reactions:*** Carbylamine test, with HNO2, Electrophilic substitution (case aniline): nitration, and, sulphonation. **B) Diazonium salts** Preparations, Reactions- Conversion of Diazonium salts to Benzene, phenol ,Sandmeyer reaction. **C) Synthesis of dyes-**, methyl orange , Congo red	**(8L)**
Unit III:	**Amino Acids, Peptides and Proteins** ***A] Preparation of Amino Acids:*** Introduction, types of amino acids, Zwitterion, Isoelectric point and Electrophoresis	**(7L)**

	B} Synthesis of amino acids: Strecker synthesis, Gabriel's synthesis, . ***B] Reactions of Amino acids*:** Acetylation of -NH2 group, ninhydrin test, biurate test, **C] Overview:** Primary, Secondary, Tertiary and quaternary structure of proteins,	
Unit IV:	**Carbohydrates** Definition , Classification and General Properties, Glucose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose, Killiyani Synthesis, Mutarotation, Structure of disacharrides, (sucrose, maltose, lactose), Structure of Polysaccharides: Cellulose and Starch	**(8L)**

Reference Books

1. Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. *Organic Chemistry* (*Volume 1*), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. *Organic Chemistry* (*Volume 2)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Nelson, D. L. & Cox, M. M., *Lehninger's Principles of Bioch*emistry *7th Ed.,* W. H. Freeman.
5. Berg, J.M., Tymoczko, J. L. &Stryer, L. *Biochemistry*, W.H. Freeman, 2002.
6. Name reactions by G. Jack Lee.

Vivekanand College, Kolhapur (Empowered Autonomous)
B. Sc. Part – II Semester - IV CHEMISTRY (Minor)
MIN-VII: MIN03CHE41: General Aspects in Inorganic Chemistry
Theory: 30 hrs
Marks-50 (Credits: 02)

Course Outcomes: After the completion of the course the student will be able to:

CO1: Gain the knowledge aboutproperties ofd-block elements.

CO2: Impart knowledge of applications of metal chelatesin Analytical chemistry

CO3: Develop the basics concepts and valence bond theory of co-ordination compounds.

CO4: Understand the basics concepts and crystal field theory of co-ordination compounds.

Unit 1:	**Transition Elements (3d series)** General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties and ability to form complexes.	**7Hrs**
Unit 2:	**Chelation** A brief introduction with respect to ligands, chelating agent, chelation and metal chelates, Structural requirements of chelate formation, Difference between metal chelate and metal complex, Classification of chelating agents (with specific illustration of bidentate chelating agents), Application of chelation with respect to chelating agents – EDTA.	**7Hrs**
Unit 3:	**Valence Bond Theory** Definition and formation of co-ordinate covalent bond in BF_3-NH_3 and $[NH_4]$*, Distinguish between double salt and complex salt, Werner's theory i) Postulates, ii) theory as applied to cobalt amines complexes; Description of the terms: ligands, co-ordination compounds, Coordination number; IUPAC system of nomenclature, Structural and stereoisomerism in complexes with coordination numbers 4 and 6.	**8Hrs**

Unit 4:	**Crystal Field Theory** Assumptions of CFT, Crystal field splitting of 'd' orbital in octahedral and tetrahedral, Crystal field stabilization energy (CFSE), Comparison of CFSE for *Oh* and *Td* complexes, Factors affecting the Magnitude of 10 Dq, Spectrochemical series, Jahn-Teller distortion, Limitations of CFT.	**8Hrs**

Reference Books:

1. Cotton, F. A. & Wilkinson, G. Basic Inorganic Chemistry, Wiley.
2. Shriver, D. F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.
3. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.
4. Rodgers, G. E. Inorganic & Solid State Chemistry, Cengage Learning India Ltd., 2008.
5. Lee, J. D. Concise Inorganic Chemistry, (ELBS, 5th Edition)
6. Puri, Sharma and Kalia; Principles of Inorganic Chemistry, Vallabh Publication, Pitampur Delhi.
7. Gopalan R. and Ramalingam V.; Concise Coordination Chemistry, Vikas Publishing House Pvt. Ltd.

Vivekanand College, Kolhapur (Empowered Autonomous)
B. Sc. Part – II Semester - IV CHEMISTRY (Minor)
MIN-VIII: MIN03CHE42: General Aspects of organic Chemistry
Theory: 30 hrs
Marks-50 (Credits: 02)

CO1: Get knowledge about different types of carboxylic acids, their preparation methods and chemical properties.

CO2: Know about Biomolecules like Amino acids and proteins, their different structures and functions.

CO3: Know the method of synthesis of dyes which is industrially important strategy involving the amines and diazonium salts.

CO4: Grasp knowledge about another biomolecue carbohydrate, their classification, structures and other phenomenons taking place in this macromolecule.

Unit I:	**Carboxylic acids and their derivatives** **A] Carboxylic acids (aliphatic and aromatic)** ***Preparation:***Acidic and Alkaline hydrolysis of esters. Carboxylation of Grignard reagent ***Reactions:*** Schimdt reaction. **B] Carboxylic acid derivatives (aliphatic):** (Upto 5 carbons) ***Preparation:***Acid halides, Anhydrides, Amides from acids and their interconversion ***Reactions:*** Esterification reaction with mechanism. Comparative study of nucleophilicity of acyl and aryl derivatives; Reformatsky Reaction, Perkin condensation and Wolf rearrangement reaction with mechanism and their applications.	**(7L)**
Unit II:	**Amines and Diazonium Salts** A)Amines: Aliphatic and Aromatic Amines (Upto 5 carbons) ***Preparation*:** From alkyl halides, alkyl nitriles, Gabriel's Phthalimide synthesis, Hofmann Bromamide Reaction. ***Reactions:*** Carbylamine test, with HNO_2, Electrophilic substitution (case aniline): nitration, sulphonation, andhalogination. **B) Diazonium salts** Preparations, Reactions- Conversion of Diazonium salts to Benzene, phenol, Sandmeyer reaction. **C) Synthesis of dyes-**, methyl orange , Congo red	**(8L)**
Unit III:	**Amino Acids, Peptides and Proteins** ***A] Preparation of Amino Acids:*** Introduction, types of amino acids, Zwitterion, Isoelectric point and Electrophoresis B} Synthesis of amino acids: Strecker synthesis, Gabriel's synthesis, . ***B] Reactions of Amino acids*:** Acetylation of -NH2 group, ninhydrin	**(7L)**

	test, biurate test, **C] Overview:** Primary, Secondary, Tertiary and quaternary structure of proteins,	
Unit IV:	**Carbohydrates** Definition , Classification and General Properties, Glucose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose, Killiyani Synthesis, Mutarotation, Structure of disacharrides, (sucrose, maltose, lactose), Structure of Polysaccharides: Cellulose and Starch	**(8L)**

Reference Books

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Nelson, D. L. & Cox, M. M., Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman.
5. Berg, J.M., Tymoczko, J. L. &Stryer, L. Biochemistry, W.H. Freeman, 2002.
6. Name reactions by G. Jack Lee.

Vivekanand College, Kolhapur (Empowered Autonomous)
B. Sc. Part – II Semester - IV CHEMISTRY (Major)
DSC-PR IV: DSC03CHE49: DSC Chemistry Lab-4
PRACTICAL: 60hrs
Marks-50 (Credits: 04)

Inorganic and Organic Chemistry

1. Organic Spotting [10]
   Carboxylic acids, phenolic, aldehydic, ketonic, amide, nitro, amines (at least 10 compounds) and preparation of two derivative.
2. Estimation of (i) Mg^{2+} by complexometric titrations using EDTA.
3. Estimation of total hardness of a given sample of water by complexometric titration.
4. To estimate HNO_2 by iodometric method.
5. To estimate the amount of Vitamin-C present ingivenVit-C tablets.
6. To estimate volumetrically the amount of acetone present in the given solution (by iodometric method)
7. Preparation of p-nitro acetanilide from acetanilide.
8. Preparation of Potash Alum.
9. Preparation of Tetra amine copper (II) suphate.
10. Preparations of hexathioureaplumbus nitrate.
11. Determination of the concentration of glycine solution by formylation method.
12. Qualitative determination of enzyme activity of amylase.
13. To determine percentage purity of a given sample of soda-ash.
14. Preparation of Phthalamide from phthalic anhydride.
15. To determine percentage of nitrogen in the given sample of a nitrogenous fertilizer(ammonium sulphate)
16. To estimate amount of ethyl benzoate in the given solution of ethyl benzoate.
17. Preparation of Benzoic acid from benzamide.
18. Preparation of Ferrous ammonium sulphate.
19. Preparation of Acetanilide from Aniline using anhydrous zn dust.
20. Estimation of Urea by hypobromide method.
21. To determine volumetrically the amounts of sodium carbonate and sodium hydroxide present together in the given solution.

Reference Books:

1) Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
2) Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
3) Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
4) Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.
5) Clarke *Handbook of Organic Quantitative Analysis*
6) Ahluvalia V. K., *Comprehensive Practical Organic Chemistry*
7) Kulkarni, V. S., Dastane, R. *Laboratory Handbook of OrganicQualitative Analysis and Separation*

Vivekanand College, Kolhapur (Empowered Autonomous)
B. Sc. Part – II Semester - IV CHEMISTRY (Minor)
MIN-PR-IV: MIN03CHE49: MIN Chemistry Lab-4
PRACTICAL: 30 hrs
Marks-25 (Credits: 02)
Inorganic and Organic Chemistry

1. Organic Spotting [5]

   Carboxylic acids, phenolic, aldehydic, ketonic, amide, nitro, amines (at least 8 compounds) and preparation of two derivative.

2. Estimation of total hardness of a given sample of water by complexometric titration.
3. Estimations of Vitamin-C from tablets.
4. Estimation of Acetone.
5. Preparation of p-nitro acetanilide.
6. Preparation of Potash Alum.
7. Preparation of Tetra amine copper sulfate.
8. Preparations of hexathioureaplumbus nitrate.
9. Determination of the concentration of glycine solution by formylation method.
10. Action of salivary amylase on starch.
11. To estimate the amount of calcium from the chalk by titrimetric method. (By redox titration using $KMnO_4$ solution).

Reference Books:

1) Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2) Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3) Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
4) Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
5) Clarke Handbook of Organic Quantitative Analysis
6) Ahluvalia V. K., Comprehensive Practical Organic Chemistry
7) Kulkarni, V. S., Dastane, R. Laboratory Handbook of OrganicQualitative Analysis and Separation

Vivekanand College, (Empowered Autonomous)
B. Sc. Part – II Semester - III CHEMISTRY (Minor)
VSC-PR-III
VSC03CHE49, ANALYSIS OF COMMERTIAL SAMPLES
Practical : 30 hrs.

1	Determination of percentage of Ca from tablet
2	Determination of percentage of chlorine from bleaching powder
3	Determination of Soil Organic Carbon by Walkey-Black Method
4	Determination of acid in the given sample of toilet cleaner
5	Determination of Dissolved Oxygen in water sample
6	Determination of S/Cu from fungicide
7	Estimation of Mg from Talcum Powder
8	Analysis of Na from water by ion exchange method
9	Estimation of Vit-C from Lemon Juice
10	Determination of Casein from Milk
11	Determination of rancidity of oil
12	To determine the alkalinity of pesticide sample
13	Conductometric determination of acetic acid in vinegar
14	To determine carbonates and bicarbonate ions against strong HCl by using pH meter.
15	To determine the amount of Cu from Brass alloy by volumetric analysis

Seat No.	

Ques. paper code	

VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)

B.Sc. Part- II (Inorganic Chemistry) (Semester-IV) Examination……..

Course Code and Name: MIN03CHE41: Inorganic Chemistry

Day: Time: 2 hours

Date: --/--/---- Marks : 40

Instructions:

1) All the questions are compulsory.

2) Figures to the right indicate full marks.

3) Draw neat labelled diagrams wherever necessary.

4) Use of log table/calculator is allowed.

Q. 1. Select correct alternative(One mark each): [8]

ix) Xyzabcdefghijklmnop ----------

a) -------- b) -------- c) -------- d) --------

x) Xyzabcdefghijklmnop ----------

a) -------- b) -------- c) -------- d) --------

xi) Xyzabcdefghijklmnop ----------

a) -------- b) -------- c) -------- d) --------

xii) Xyzabcdefghijklmnop ----------

a) -------- b) -------- c) -------- d) --------

xiii) Xyzabcdefghijklmnop ----------

a) -------- b) -------- c) -------- d) --------

xiv) Xyzabcdefghijklmnop ----------

a) -------- b) -------- c) -------- d) --------

xv) Xyzabcdefghijklmnop ----------

a) -------- b) -------- c) -------- d) --------

xvi) Xyzabcdefghijklmnop ----------

a) -------- b) -------- c) -------- d) --------

Q.2. Attempt any TWO (Eight marks each): [16]

iv) Xyzabcdefghijklmnop.

v) Xyzabcdefghijklmnop.

vi) Xyzabcdefghijklmnop.

Q.3. Attempt any FOUR (Four marks each): [6]

i) Xyzabcdefghijklmnop.

ii) Xyzabcdefghijklmnop.

iii) Xyzabcdefghijklmnop.

iv) Xyzabcdefghijklmnop.

v) Xyzabcdefghijklmnop.

vi) Xyzabcdefghijklmnop.