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

Swami Vivekanand Shikshan Sanstha's

Vivekanand College, Kolhapur (Autonomous)

Syllabus

For

Bachelor of Science

B. Sc. Part - II Chemistry

(Semester III, IV)

Under Choice Based Credit System

Syllabus with effect from the June, 2022

(Subject to modifications in the future)

Vivekanand College, Kolhapur (Autonomous)
Department of Chemistry
B. Sc. Part - II Syllabus (CBCS Pattern)
In force from June - 2022

INTRODUCTION

This syllabus is prepared to give the sound knowledge and understanding of chemistry to undergraduate students at second year of the B.Sc. degree course. The goal of the syllabus is to make the study of chemistry as stimulating, interesting and relevant as possible. The syllabus is prepared by keeping in mind the aim to make students capable of studying chemistry in academic and industrial courses. Also to expose the students and to develop interest in them in various fields of chemistry. The new and updated syllabus is based on disciplinary approach with vigour and depth taking care of the syllabus is not heavy at the same time it is comparable to the syllabi of other universities at the same level.

The syllabus is prepared after discussions of number of faculty members of the subject and by considering the existing syllabi of B.Sc. Part-I, II & III, XIth & XIIth standards, NET; SET examination, U.G.C. model curriculum, different entrance examinations, other Universities and other autonomous institutes.

The units of the syllabus are well defined and the scope is given in detail. The periods required for units are given. The lists of reference books are given in detail.

OBJECTIVES

To enable the students

- To promote understanding of basic facts and concepts in Chemistry while retaining the excitement of Chemistry.
- To make students capable of studying Chemistry in academic and Industrial courses.
- To expose the students to various emerging new areas of Chemistry and apprise them with their prevalent in their future studies and their applications in various spheres of chemical sciences.
- To develop problem solving skills in students.
- To expose the students to different processes used in Industries and their applications.
- To develop ability and to acquire the knowledge of terms, facts, concepts, processes, techniques and principles of subjects.
- To develop ability to apply the knowledge of contents of principles of chemistry.
- To inquire of new knowledge of chemistry and developments therein.
- To expose and to develop interest in the fields of chemistry.
- To develop proper aptitude towards the subjects.
- To develop the power of appreciations, the achievements in Chemistry and role in nature and society.
- To develop interest in students to study chemistry as a discipline.
- To develop skills required in chemistry such as the proper handling of apparatus and chemicals.

List of Laboratory equipment & Chemicals required

Apparatus &equipments and chemicals required.

Viscometer	Measuring cylinder	Wire gauze	Burette stand
Stop watch	Stopper bottle	Burner	Iron stand
Eudiometer	Test tube, Beaker	Water bath	Test tube holder
Digital balance	Thile's tube	Chromatography paper	Test tube stand
Burette, pipette and conical flask	Capillary tube	Gas jar	Spot tile
1/100°C thermometer	Evaporating dish	Watch glass	Dropper
Polythene bottles	Glass rod	Tripod stand	Dryer

General Structure

There will be two theory papers each of 35 marks for each semester and internal examination of 15 marks.

Semester	Course Opted	Course Name	Credits
III	DSC-1002C_1-Part-I	Physical Chemistry	2
	DSC-1002C_2-Part-II	Analytical & Industrial Chemistry	2
IV	DSC-1002D_1-Part-I	Inorganic Chemistry	2
	DSC-1002D_2-Part-II	Organic Chemistry	2
	Skill Enhancement Course (SEC-II)	Basics in Practical Chemistry	4
III & IV	Core Course- Practical	Chemistry Lab I: DSC-1002C Physical and Analytical & Industrial Chemistry	2
	Core Course- Practical	Chemistry Lab II: DSC-1002D Inorganic& Organic Chemistry	2

There will be annual practical examination. Practical will be of 50 marks. Physical, Inorganic and Organic chemistry carries 15 marks each. Five marks are reserved for journal. The duration of practical examination will be of six hours.

Vivekanand College, Kolhapur (Autonomous)
B. Sc. Part-II (Chemistry) CBCS Syllabus with effect from June, 2022 Semester-III
DSC-1002C$_I$-Part-I: Physical Chemistry
Theory: 30hrs (37 Periods) Credits-2

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

CO1: Acquire knowledge regarding properties of matter.

CO2: Enhance critical thinking and problem-solving ability.

Unit 1: Chemical Kinetics **(09L)**

Introduction, the concept of reaction rates, order and molecularity of a reaction, zero, first order reaction (Derivation not expected). Second order reactions (both for equal and unequal concentrations of reactants) of general equations for rate constants, Characteristic properties of second order reaction, examples. General methods for determination of order of a reaction, Concept of activation energy: Activated complex theory and Collision Theory and calculation of activation energy by Arrhenius equation, Numerical Problems.

Unit 2: Kinetic Theory of gases **(08L)**

Introduction, postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation, Deviation of real gases from ideal behavior, compressibility factor, causes of deviation, van der Waals equation of state for real gases, Boyle temperature (derivation not required), critical phenomena, critical constants and their calculation from van der Waals equation. Andrews's isotherms of CO_2, Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules.

Unit 3: Phase Equilibria **(07L)**

Introduction of phases, components and degrees of freedom of a system, criteria of phase equilibrium, Gibbs Phase Rule, Phase diagrams of one component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, $FeCl_3$-H_2O and KI-Water only), Three Component System (Benzene-water-Chloroform)

Unit 4: Properties of Liquids **(05L)**

Introduction, Classification of physicalproperties, surface tension and chemical constitution, use of Parachor value in elucidating molecular, Viscosity- coefficient of viscosity, determination of viscosity by Ostwald's Viscometer, Refractive index – measurement of refractive index by Abbe's refractometer, specific and molecular refraction, molecular refractivity, Numerical problem.

Unit 5: Electrochemistry-I (Conductance) **(08L)**

Introduction, Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes, Transference number and its experimental determination using moving boundary methods, Kohlrausch law of independent migration of ions, applications of conductance measurements: determination of degree of ionization of weak and strong electrolyte, conductometric titrations- Strong Acid-Strong Base, Weak Acid-Strong Base.

Reference Books:

1. Barrow, G. M., Physical Chemistry, Tata McGraw-Hill (2007).
2. Castellan, G.W., Physical Chemistry 4th Ed. Narosa (2004).
3. Kotz, J. C., Treichel, P. M. & Townsend, J. R., General Chemistry, Cengage Learning India Pvt. 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. Essentials of Physical Chemistry by B. S. Bahl and G. D. Tuli. (S.Chand.)
7. Chemical Kinetics by K. J. Laidler (Tata Mc-Graw Hill Publishing Co. Ltd.)
8. Principles of Chemistry by Puri and Sharma (S.Nagin.)
9. Physical Chemistry through problems by S. K. Dogra, D. Dogra (Wiley Eastern Ltd.)
10. Physical Chemistry by G. M. Barrow (Tata Mc-Graw Hill publishing Co., Ltd.)
11. Elements of Physical Chemistry by S. Glasstone and D. Lewis. (D.VanNostrand Co. Inc.)

Semester-III

DSC-1002C$_2$-Part-II: Analytical & Industrial Chemistry

Theory: 30hrs (38 Periods) Credits-2

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.

Unit 1: Gravimetric Analysis **(6L)**

General introduction, Common ion effect and solubility product principles, Conditions for good precipitation, Factors affecting to precipitation like acid, 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.

Unit 2: Conductometric Analysis **(6L)**

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.

Unit 3: Inorganic Semi-Micro Qualitative Analysis **(8L)**

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^- and NO_3^- in mixture, Spot test analysis.

Unit 4: Unit Operations & Unit Processes **(10L)**

Introduction, Meaning of unit operations and processes & its types, **Distillation** - Distillation of liquid mixtures, Types of distillation, Types of columns, packings and Condensers, Vacuum distillation, Spinning-band distillation and Steam distillation.

Modes of Manufacturing: Batch, Semi-batch, Continuous Study of Unit processes & unit operations involved in manufacturing of ethanol by catalytic hydration of ethylene in vapour phase.

Unit 5: Corrosion and Electroplating **(8L)**

Corrosion: Introduction of corrosion, Electrochemical theory of corrosion, Factors affecting on corrosion -i. Position of metals in the electrochemical series on the basis of standard reduction potential ii. Purity of metal iii. Effect of moisture iv. Effect of oxygen (differential aeration principle) v. Hydrogen overvoltage, Methods of protections of metals from corrosion.

Electroplating: Basic principles of electroplating, Electrolysis, Faraday's laws, Cathode current Efficiency, Cleaning of articles, Electroplating of chromium, Anodising.

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) Principles of electroplating and electroforming by Blum and Hogaboom
6) Lee, J. D. Concise Inorganic Chemistry, (ELBS, 5th Edition)
7) Puri, Sharma and Kalia; Principles of Inorganic Chemistry, Vallabh Publication, Pitampur Delhi.

Vivekanand College, Kolhapur (Autonomous)

B. Sc. Part - II (Chemistry) CBCS Syllabus with effect from June, 2022

Semester-IV

DSC-1002D$_1$ - Part - I: Inorganic Chemistry

Theory: 30hrs (38 Periods) Credits-2

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

CO1: Gain the knowledge of p & d-block elements.

CO2: Develop the basics, theories and applications of co-ordination compounds and metal-chelates.

Unit 1: Transition Elements (3d series) **(5L)**

General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties and ability to form complexes.

Unit 2: p-block Elements (Group 15 and 16) **(8L)**

Position of elements in periodic table, Charactristics of p-block elements with special reference to electronic configuration and periodic properties, Allotropic forms of Sulphur and Phosphorus, Oxoacids of nitrogen, phosphorus and sulphur (HNO_2, HNO_3, H_3PO_3, H_3PO_4, H_2SO_3, H_2SO_4)

Unit 3: Coordination Chemistry: Theories of Metal Complexes **(12L)**

A] 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; 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.

Unit 4: Coordination Chemistry: Theories of Metal Complexes **(8L)**

B] 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

Unit 5: Chelation **(5L)**

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.

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.

Semester - IV
DSC - 1002D$_2$ – Part - II: Organic Chemistry
Theory: 30hrs (37 Periods) Credits-2

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

CO1: Prepare different organic compounds.

CO2: Acquire knowledge of application and utilization of organic compounds.

CO3: Understand the structure, types and reactions of biomolecules.

Unit I: **Carboxylic acids and their derivatives** **(8L)**

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): (Up to 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.

Unit II: **Amines and Diazonium Salts** **(9L)**

Aliphatic and Aromatic Amines (Upto 5 carbons)

***Preparation*:** From alkyl halides, alkyl nitriles, Gabriel's Phthalimide synthesis, Hofmann Bromamide Reaction.

Reactions: Carbylamine test, Heinsberg test, with HNO2, Gomberg's Reaction, Electrophilic substitution (case aniline): nitration, and, sulphonation.

Diazonium salts: Preparation from aromatic amines, -Diazotisation methods, Synthesis of methyl orange dye, Congo red dye. Orientation at o-, m-, and p-positions

Reactions- Conversion of Diazonium salts to Benzene, phenol; Conversion of diazonium salt into benzene, phenol, Sandmeyer reaction

Unit III: Amino Acids, Peptides and Proteins **(8L)**

A] Preparation of Amino Acids: Strecker synthesis using Gabriel's phthalimide synthesis, Zwitterion, Isoelectric point and Electrophoresis.

***B] Reactions of Amino acids*:** acetylation of -NH2 group, ninhydrin test, biurate test, overview of Primary, Secondary, Tertiary and quaternary structure of proteins, Denaturation of proteins.

Unit IV: Carbohydrates **(12L)**

Definition, Classification and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Killiyani Synthesis, Mutarotation, ascending and descending in monosaccharides, Structure of disacharrides, (sucrose, cellobiose, maltose, lactose hydrolysis reaction of Disaccharides (sucrose, cellobiose, maltose, lactose), determination of size of ring, Degradation of carbon chain.

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.

Skill Enhancement Course (SEC)

Basics in Practical Chemistry

Theory & Hands on

- **Basics in Practical Chemistry**

Introduction, Definition and Explanation of following terms- Solute, Solvent, Solution, Polar solvent, Non-Polar solvent, Saturated solution, Unsaturated solution, Super saturated solution, Normality, Equivalent weight, Molecular weight, Molarity, Acidity of base, Basicity of acid, Percentage solution, ppt, ppm, ppb solutions, Mole Fraction, Weight fraction, Percentage composition by W/W, W/V, V/V Problems based on Normality, Molarity, mole fraction, mixed solution, etc.

- **Preparation of solution of different concentration:** Normal, Molar, Molal, ppm, ppb, ppt, percentage, etc.
- **Analysis of water:** Determination of dissolved oxygen (DO) of a water sample.
- **Chromatography:** Paper chromatographic separation of mixture of metal ion.
- **Ion exchange chromatography:** Determination of ion exchange capacity of anion/ cation exchange resin.
- Analysis preservatives and colouring matter from food.
- Determination of constituent of talcum powder.

B. Sc. II
DSC-1002C & 1002D Syllabus for Practical

Chemistry Lab-I: DSC-1002C Physical and Analytical & Industrial Chemistry

1. Determination of the surface tension of a liquid or a dilute solution using a Stalagmometer.
2. Study of the variation of surface tension of a detergent solution with concentration.
3. Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.
4. To investigate the reaction between potassium per sulphate and KI (Equal Concentration)
5. To investigate the reaction between potassium persulphate and KI (Unequal Concentration)
6. To study the hydrolysis of methyl acetate in presence of HCl and H_2SO_4 and to determine relative strength.
7. To determine Cell Constant of the given Conductivity cell and to verify Ostwald dilution law using acetic acid Solution Conductometrically.
8. To determine the normality of given strong acid and weak acid by titrating it against strong base Conductometrically.
9. To determine the normality of given strong acid by titrating it against strong base Potentiometrically.
10. Preparations of Ferrous ammonium sulphate (Mohr's salt).
11. Preparation of Potash Alum.
12. Preparation of Tetraamine copper sulfate
13. Preparation of methyl orange
14. Preparation of p-nitro acetanilide

Chemistry Lab-II: DSC-1002D Inorganic and Organic Chemistry

Inorganic Chemistry

1. Semi-micro qualitative analysis using H_2S of mixtures - not more than four ionic species (two anions and two cations and excluding insoluble salts) out of the following:

Cations: NH_4^+, Cu^{2+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Cr^{3+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, K^+, Mg^{2+}

Anions: CO_3^{2-}, S^{2-}, SO^{2-}, $S_2O_3^{2-}$, NO_3^-, CH_3COO^-, Cl^-, Br^-, I^-, SO_4^{2-}, $C_2O_4^{2-}$, F^- *(Spot tests should be carried out wherever feasible).*

2. Estimate the amount of metal present in a given solution gravimetrically. (Any three)
    a) Ni as Ni-DMG
    b) Ba as $BaSO_4$
    c) Fe as $Fe(OH)_3$
    d) Al as Al oxalate.
3. To determine the unknown concentration of given coloured compounds ($KMnO_4$/ $CuSO_4$) Colorimetrically.
4. Estimation of (i) Mg^{2+}or (ii) $Zn^{2+}$by complexometric titrations using EDTA.
5. Estimation of total hardness of a given sample of water by complexometric titration.
6. To determine volumetrically the amounts of sodium carbonate and sodium hydroxide present together in the given solution.
7. Determination of alkali content of antacid tablet using HCl.
8. To estimate H_2O_2 by Iodometric method.

Organic Chemistry

1. **Organic Spotting:**Carboxylic acids, phenolic, aldehydic, ketonic, amide, nitro, amines (at least 6 compounds) and preparation of one derivative.
2. Determination of the concentration of glycine solution by formylation method.
3. Estimations of Vitamin-C from tablets
4. Action of salivary amylase on starch
5. Estimation of Acetone
6. Differentiation between a reducing and a non-reducing sugar.

Reference Books:

1. 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.
2. Mann, F. G. & Saunders, B. C. Practical Organic Chemistry, Orient-Longman, 1960.
3. Khosla, B. D.; Garg, V. C. & Gulati, A., Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
4. Ahluwalia, V. K. & Agarwal, R., Comprehensive Practical Organic Chemistry, Universities Press.

5. Svehla, G., Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
6. Mendham, J., Vogel's Quantitative Chemical Analysis, Pearson, 2009.
7. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).

B. Sc. Part II, Sem-III & IV Examination Pattern

For B.Sc. II Chemistry Theory Exam

Sr. No.	Internal Examination DSC Course				Total (a+b+c+d)	Conversion of 60 marks in Total (I) (e)	SEE (Semester End Examination) DSC Course		Total (II) (f+g)= h	Total (I and II) (e+h) = i
	Cours-I (Two tests each of 10 marks) (a)	Course -II (Two tests each of 10 marks) (b)	Home assignment Course I (c)	Home assignment Course II (d)			Paper-I (f)	Paper-II (g)		
1	15	15	15	15	60	**30**	**35**	**35**	**70**	**100**

Nature of Internal and SEE (Semester End Examination) Examination

1) For internal examination there shall be conversion of 60 marks into 30 marks and for passing 11 marks is required out of 30.
2) For SEE (Semester End Examination), there shall be two papers (Part I and Part II) of each DSC course separately per semester, each of 35 marks.
3) There shall be combined passing for SEE (Semester End Examination) of Part-I and Part-II i.e. 26 marks is required out of 70
5) There shall be separate passing for both internal and Semester End Examination (SEE).

B. Sc. II Practical Examination

Sr. No.	Physical & Analytical Chemistry	Inorganic & Organic Chemistry	Journal	Total
1.	45	45	10	100

VIVEKANAND COLLEGE KOLHAPUR (Autonomous) ESTD JUNE 1964

Nature of Question Paper
B. Sc. - II Semester: III & IV
Course - I & II

Time: 2 hours **Total Marks: (35)**

Instructions: (1) **All** questions are **compulsory.**
(2) Figures to the **right** indicate **full** marks.
(3) Draw **neat** labeled diagrams **wherever** necessary.
(Paper setter may add or delete any instruction if required)

Q.1a. Select correct alternative. **(5)**

(i) ----------
a) b) c) d)

(ii) ----------
a) b) c) d)

(iii) ----------
a) b) c) d)

(iv) ----------
a) b) c) d)

(v) ----------
a) b) c) d)

Q.1b. Fill in the blanks **(2)**

(i)
(ii)

Q. 2. Attempt any two **(14)**

(i)
(ii)
(iii)

Q.3. Attempt any four **(14)**

(i)
(ii)
(iii)
(iv)
(v)
(vi)

VIVEKANAND COLLEGE * ESTD. JUNE 1964 * KOLHAPUR-416 003

HEAD
DEPARTMENT OF CHEMISTRY
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