Rayat Shikshan Sanstha's

Sadguru Gadge Maharaj College, Karad

(Autonomous)

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

1. TITLE: B.Sc. Chemistry (Major)
2. YEAR OF IMPLEMENTATION: 2024-25
3. PREAMBLE:

This updated syllabus is prepared for second year undergraduate students, to develop their interest towards chemistry and 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 yearof their graduation. The units in the syllabus are well defined with scope and the number of lectures. The references are mentioned with relevance.

4. GENERAL OBJECTIVES OF THE COURSE:
    1. The content of the syllabus have been framed as per the UGC norms.
    2. The students are expected to understand the fundamentals, principles, mathematical concepts and recent developments in the subject area.
    3. The practical course is in relevance to the theory courses to improve the understanding of the concepts.
5. DURATION: one year
6. PATTERN: Semester
7. MEDIUM OF INSTRUCTION: English

STRUCTURE OF COURSE:

9) OTHER FEATURES:

A) LIBRARY: Reference and Textbooks, Journals and Periodicals, Reference Books for Advanced Books for chemistry Advanced studies. –List Attached

B) SPECIFIC EQUIPMENTS: Necessary to run the Course, Computer, LCD, Projector, Visualizer, Smart board

C) LABORATORY EQUIPMENT'S: Apparatus, equipment's and chemicals required.

I) THIRD SEMESTER ---------(NO. OF PAPERS 2)

Paper V: Physical Chemistry (MJBCT23-301)

Paper VI: Analytical Chemistry (MJBCT23-302)

Practical III: (MJBCP23- 303)

II) FOURTH SEMESTER --------(NO. OF PAPERS 2)

Paper VII: Inorganic Chemistry (MJBCT23-401)

Paper VIII: Organic Chemistry (MJBCT23-402)

Practical IV: (MJBCP23-403) (Practical Examination is semester wise)

B.Sc. II Course Structure as Per NEP

Sem	DSC (Major)	DSE Minor-I)	AEC (Language)	Value added courses	SEC	IKS/CC/Sumer internship/OJT/FP	Total Credits
III	**Physical Chemistry -V (2)Analytical Chemistry - VI(2) Practical-III (4)**	**xyz- V (2) Practical-III (2)**	English **(2)**	**VAC-I (2)** Democracy **AEC-I (2)** Environmental Sci.	**SEC-II** Basic Soiland water analysis**(2)** **SEC-III** Laboratory Courses in soil and wateranalysis **(2)**	----------	**22**
IV	**Inorganic Chemistry-III (2) Organic Chemistry-IV (2) Practical-IV (4)**	**xyz-VI (2) Practical-IV (2)**	English **(2)**	**AEC-II (2)** Environmental Sci.	**SEC-IV** Food Science and Technology **(2)** **SEC-V** Laboratory Course in food Science and Technology **(2)**	**CC (2)**	**22**
Total Credits	**08 +08 =16**	**04 +04 =08**	**04**	**06**	**08**	**02**	**44**

7) Examination Pattern:

Semester	Paper No.	Theory Exam. SEE	Internal Exam CCE	Total Marks
Semester III	Paper V (MJBCT23-301)	40	10	100
	Paper VI (MJBCT23-302)	40	10	
	Practical III MJBCP23-303	50	-	50
Semester IV	Paper VII (MJBCT23-401)	40	10	100
	Paper VIII (MJBCT23-402)	40	10	
	Practical IV (MJBCP23-403)	50	-	50
			Total marks:	300

8) Credit System –

Semester	Paper No.	Name of Paper	Distribution of Marks		Total Marks	Credits
			SEE	CCE		
Semester III	Paper V (MJBCT23-301)	Physical Chemistry	40	10	50	2
	Paper VI (MJBCT23-302)	Analytical Chemistry	40	10	50	2
	Practical Examination III (MJBCP23- 303)	Practical III	50	-	50	4
Semester IV	Paper VII (MJBCT23-401)	Inorganic Chemistry	40	10	50	2
	Paper VIII (MJBCT23-402)	Organic Chemistry	40	10	50	2
	Practical Examination IV (MJBCP23-403)	Practical IV	50	-	50	4
Total					300	16

9) Nature of Question Paper for Semester Pattern

Time: - 2 hrs. **Total Marks-40**

Instructions:

1. All questions are compulsory.
2. Numbers in right indicate full marks.
3. Use of scientific calculator is allowed.

Q. No.1) Multiple choice questions. (1 x 08) … (08)

Q.No.2) Attempt any two out of three (2 x 08) … (16)

Q.No.3) Attempt any four out of six (4 x 04) **……** (16)

Internal Examination

CCE - Marks =10

10) Practical Examination – Semester III

No. of Days-1 **Total Marks-50**

1) Physical Chemistry Experiment 20 marks

2) Analytical Chemistry Experiment 20 marks

3) Journal & Oral.....10 marks

Total = 50 marks.

11) Practical Examination – Semester IV

No. of Days-1 **Total Marks-50**

1) Inorganic Chemistry Experiment 20 marks

2) Organic Chemistry Experiment 20 marks

3) Journal & Oral.....10 marks

Total = 50 marks.

B.Sc. II Semester III

Paper V: Physical Chemistry (MJBCT23-301)

Marks: 40

Subject	Unit No.	Title	Periods	Credits
Physical Chemistry	I	Electrochemistry	**10**	**2**
	II	Thermodynamics	**07**	
	III	Nuclear Chemistry	**07**	
	IV	Chemical Kinetics	**06**	
Grand total			**30**	

Paper VI: Analytical Chemistry (MJBCT23-302)

Marks: 40

Subject	Unit No.	Title	Periods	Credits
Analytical Chemistry	I	Optical methods of analysis	**10**	**2**
	II	Electro analytical methods	**08**	
	III	Qualitative Analysis	**06**	
	IV	Gravimetric analysis	**06**	
Grand Total			**30**	

Semester IV

Paper VII - Inorganic chemistry (MJBCT23- 401)

Marks: 40

Subject	Unit No.	Title	Periods	Credits
Inorganic Chemistry	I	Inorganic Semi micro qualitative Analysis	**06**	**2**
	II	Chemistry of elements of first transition series	**06**	
	III	Co-ordination chemistry	**12**	
	IV	Chelation	**06**	
Grand Total			**30**	

Paper VIII: Organic chemistry (MJBCT23- 402)

Marks: 40

Subject	Unit No.	Title	Periods	Credits
Organic Chemistry	I	Amines	**06**	**2**
	II	Heterocyclic Compounds	**08**	
	III	Organic Named Reactions and Synthetic Reagents	**10**	
	IV	Stereochemistry	**06**	
Grand Total			**30**	

B.Sc. Part II: Chemistry

Semester III

Theory: Paper V: Physical Chemistry (MJBCT23-301)

Marks: 40 **Credits: 2**

Expected Learning Outcomes:

Unit No.	Name of the Topic	Expected Learning Outcomes
I	Electrochemistry	Learning and understanding conductivity and transport number of the aqueous solutions with different applications.
II	Thermodynamics	Knowledge about entropy, third law of thermodynamics and different aspects of entropy will be gained by students.
III	Nuclear Chemistry	Learning the various nuclear phenomena and measurement of nuclear radiations.
IV	Chemical Kinetics	Learning and understanding the knowledge about third order reaction and theories of reaction rates.

Unit- I Electrochemistry **(10L)**

Recapitulation of the basic terms, Debye – Huckel theory of conductance of strong electrolytes (Derivation not expected), Debye-Huckel limiting law (Equation and Explanation of the terms), Migration of ions, Hittorf's rule, Transport number, Determination of transport number using Moving boundary method, Factors affecting transport numbers, Kohlrausch law of independent migration of ions and its applications such as relationship between ionic conductance, ionic mobility and transport number, Determination of degree of ionization of weak electrolyte, Determination of equivalent or molar conductance at infinite dilution for weak electrolytes, Solubility and solubility products of sparingly soluble salts, Numerical problems.

Unit- II Thermodynamics **(07L)**

Concept of entropy: Introduction, Definition, Mathematical expression, Unit, Physical significance of entropy. Entropy changes for reversible and irreversible Processes for isothermal systems, Entropy changes for an ideal gas as function of V and T and as a function of P and T, Entropy change in mixing

of gases, Entropy change accompanying phase transitions, Third law of thermodynamics, Absolute entropy and determination of absolute entropy, Numerical problems.

Unit – III Nuclear Chemistry **(07L)**

Introduction, Types of Nuclear radiation, properties of α, β and γ radiations, Detection and measurement of nuclear radiations by Scintillation and Geiger - Muller counter methods, radioactive equilibrium and range of α- particles, Geiger-Nuttal relations, Determination of radioactive constant (decay constant),Numerical problems.

Unit - IV Chemical Kinetics **(06L)**

Introduction, Third order reaction: Derivation of rate constant, characteristics and examples of third order reaction. Determination of order of reaction by (i) integration method (ii) graphical method (iii) half-life method, Effect of temperature on rate of reaction, Arrhenius equation, Concept of energy of activation, Theories of reaction rates as Collision theory and Transition state theory (only quantitative aspect, derivation not expected), Numerical problems.

References:

1. Principles of Chemistry by Puri and Sharma (Vishal Publishing Company,4th edition).
2. Essentials of Physical Chemistry by B. S. Bahl and G. D. Tuli. (S.Chand.). Unit-I,II,III,IV
3. Elements of Physical Chemistry by P. W. Atkins. (Oxford University Press.)
4. Physical Chemistry through problems by S. K. Dogra, D. Dogra (Wiley Eastern Ltd.)
5. Advanced Chemistry by Philip Mathews, (Cambridge University.)
6. An introduction to electrochemistry by S. Glasstone. (Mac Millan.)
7. A Text Book of physical Chemistry, by A.S.Negi and S.C. Anand, New Age International publ, 2nd Ed.
8. Advanced Physical Chemistry by Gurdeep Raj
9. Text Book of Physical Chemistry by K.L. Kapoor

Paper VI: Analytical Chemistry: MJBCT23- 302

Marks: 40 **Credits: 2**

Expected Learning Outcomes:

Unit No.	Name of the Topic	Expected Learning Outcomes
I	Optical methods of analysis	Learning and understanding different optical methods of analysis and corrosion
II	Electro analytical methods	Learning and understanding different Electro-analytical methods of analysis.
III	Water analysis	Learning and understanding of properties and analysis techniques of water.
IV	Gravimetric analysis	Learning and understanding basic concepts in gravimetric analysis.

Unit I: Optical methods of analysis [10L]

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.

UV-Visible Spectrometry: Basic principle and instrumentation (choice of source, monochromator and detector) for single and double beam instrument.

Nephelometry and Turbidometry: Basic principle, instrumentation and applications.

Unit II: Electro analytical methods [08L]

Classification of electro analytical methods, Basic principle of i) pH metric, ii) Potentiometric and iii) Conductometric Titrations

Introduction, Instrumentation (Conductance measurement- Direct reading conductivity bridge, conductivity cell and cell constant), Types of conductometric Titrations, Advantages and disadvantages of conductometric Titrations.

Unit II Water Analysis [06 L]

Physical analysis of water: pH, Conductance, Color, Odor, Turbidity and taste, Chemical Analysis Total dissolved solids, Hardness and its determination, Salinity, Alkalinity, Acidity Sulphates, Nitrates, Dissolved oxygen, Chemical oxygen demand, Biological oxygen demand.

Unit IV: Gravimetric analysis [06L]

i) Definition & types of gravimetric analysis ii) Precipitation technique with respect to theory iii) Solubility consideration; Common ion effect; diverse Ion effect; pH; Temperature and nature of solubility. iv) Digestion v) Nucleation vi) Co & post precipitation vii) Filtration & washing viii) Drying & Ignition of precipitate

Reference Books:

1. Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons, 1989. Unit-V

2. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods of Analysis, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA,1988. 27. Unit-II, III.

3. Christian, G.D; Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.Unit-I

4. Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.

5. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International Publisher,

2009.Additional Reading. Unit-V, IV

6. Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed. Unit-I

7. Mikes, O. Laboratory Hand Book of Chromatographic & Allied Methods, Elles Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979. Unit- I

8. Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand, 1974.

9. Shreves chemical processes industries. Unit-V

10. Industrial chemistry by B. K. Sharma. Unit-V

11. J. Mendham, Vogels A Text books of Quantitative Chemical Analysis. Unit-V

12. Walter. E. Haris, An Introduction to Chemical Analysis. Unit-V

13. Douglas A. Skoog, Fundamentals of Analytical Chemistry. Unit-V,V(a)

14. G. Svehla, Vogels Qualitative Inorganic Analysis, Pearson. Unit- IV

15. R. M. Verma, Analytical Chemistry Theory & Practice. Unit-IV

16. W. Bernagrd King, Experiments in General Chemistry. Unit-IV

Practical Course III MJBCP23: 303

Learning Objectives:

1. To study different instruments.
2. Students learn to operate viscometer and measures time of flow for liquids.
3. Measurement of refractive index and calculation of specific and molar refractivities.
4. Determines normality by titrations of strong acid Vs. strong base

Note: 1. Use of Electronic / Analytical Balance is allowed.

2. Use of scientific calculator is allowed.

Physical Chemistry Section

Part[A] :Instrumental

1. Viscosity :

To determine the percentage composition of a given liquid mixture by viscosity method. (Density data to be given).

2. Refractometry :

To determine the specific and molar refractions of benzene, toluene and xylene by Abbe's refractometer and hence determination of the refraction of $-CH_2-$ group (Methylene group). (Densities should be determined by students.)

3. Conductometry:

a) Determination of cell constant of a conductivity cell using standard KCl (N/10 or N/50)solutions.

b) To determine degree of dissociation and dissociation constant of acetic acid avarious dilutions and to verify Ostwald's dilution law conductometrically.

c) To determine the normality of the given strong acid by titrating it against strong alkali conductometrically.

d) To determine the normality of the given weak acid by titrating it against strong alkali conductometrically.

Part [B]: Non - Instrumental

4. Chemical Kinetics

1) To study the hydrolysis of methyl acetate in presence of HCl and H_2SO_4 and todetermine the relative strength of acids.

2) To study the effect of acid strength (0.5 M and 0.25 M HCl) on hydrolysis of an ester.

3) To study the kinetics of the reaction between $K_2S_2O_8$ and KI in solution with unequal initial concentration of the reactants.

Analytical Chemistry Section

Part [A]: Non - Instrumental

1) Determination of percentage purity of boric acid using supplied sodium hydroxide

2) Determination of titrable acidity in the given sample of milk or lassi of alkali content of antacid tablet using HCl.

3) Determination of percentage of nitrogen present in the given sample of nitrogenous fertilizer

4) Preparation of azo dye

5) Estimation of ester

6) Determination COD in water samples

Part [B]: Instrumental

1) **Colorimetry:** Determination of unknown concentration of potassium permanganate solution.

2) **$_P$H metry:** Determination of $_P$H of given soil samples

Practical references:

1. Practical manual in water analysis by Goyal and Trivedi.
2. Basic concepts in Analytical chemistry by S.M.Khopkar
3. Experimental Physical Chemistry by A. Findlay. *(Longman.)*
4. Advanced Practical Physical Chemistry by J.B. Yadav. *(Goel Publishing house, Meerut.)*
5. Experiments in Physical Chemistry by R. C. Das and B. Behra.*(Tata McGraw Hill.)*
6. Advanced experimental Chemistry Vol. I. Physical by J. N.Gurtu&R. Kapoor. *(S. Chand &Co.)*
7. Experiments in Physical Chemistry by J. C. Ghosh, *(BharatiBhavan.)*
8. Systematic Experimental Physical Chemistry – by S. W. Rajbhoj, Chondhekar. *(Anjali Publ.)*
9. Practical Physical Chemisty – by B. D. Khosala& V. C. Garg. R.*(S.Chand& Sons.)*

Semester –IV

Paper VII: Inorganic Chemistry: MJBCT23- 401

Marks: 40 **Credits: 2**

Expected Learning Outcomes:

Unit No.	Name of the Topic	Expected Learning Outcomes
I	Inorganic Semi-micro Qualitative Analysis	Learning and understanding of Separation and identification cations and Anions
II	Chemistry of elements of first transition series	Learning and understanding of Elements of 3d series.
III	Co-ordination chemistry	Learning and understanding basic principles of co-ordination chemistry.
IV	Chelation	Learning and understanding basic concepts in complexes.

Unit-I Inorganic Semi-micro Qualitative Analysis [**6 L]**

1.1 Theoretical principles involved in qualitative analysis.

1.2 Applications of solubility product and common ion effect in separation of cations into groups.

1.3 Applications 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 NO2 - , NO3 - (Brown ring test).

1.4 Application of oxidation and reduction in

a) Separation of Cl- , Br- , I - in mixture

b) Separation of NO2 – and NO3 – in mixture.

1.5 Spot test analysis.

Unit II: Chemistry of elements of first transition series **[06 L]**

2.1 Position of elements in periodic table

2.2 Characteristics of d-block elements with special reference to

i) Electronic structure

ii) Oxidation states

iii) Magnetic character

iv) Colored ions

v) Complex formation.

Unit III: Co-ordination Chemistry **[12 L]**

3.1 Introduction

3.2 Distinction between double salt and complex salt

3.3 Definition and formation of co-ordinate covalent bond in BF_3 -NH_3,$[NH_4]^+$

3.4 Werner's theory: Postulates

The theory as applied to cobalt ammines viz. $CoCl_3.6NH_3$, $CoCl_3.5NH_3$, $CoCl_3.4NH_3$, $CoCl_3.3NH_3$.

3.5 Description of the terms: ligand, co-ordination number, co-ordination sphere

3.6 Effective atomic number

3.7 IUPAC nomenclature of coordination compounds.

3.8 Isomerism in complexes with C.N. 4 and 6

a) Geometrical Isomerism

b) Optical Isomerism

c) Structural Isomerism-Ionization Isomerism, Hydrate Isomerism, Coordination Isomerism, Linkage Isomerism and Co-ordination position Isomerism

3.8 Valance bond theory of transition metal complex with respect to

a) C.N. 4: complexes of Cu and Ni

b) C.N. 6 complexes of Fe and Co

Unit IV: Chelation [6 L]

1.1 A brief introduction with respect to ligands, chelating agent, chelation and metal chelates.

1.2 Structural requirements of chelate formation

1.3 Difference between metal chelate and metal complex

1..4Classification of chelating agents (with specific illustration of bidentate chelating agents)

4.5 Application of chelation with respect to chelating agents: EDTA and DMG

Reference Books:

1. Petrucci, R.H. *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York (1985). Unit-I,II
2. Cotton, F.A.& Wilkinson, G. *Basic Inorganic Chemistry,* Wiley.Unit-I,II,III,IV
3. Puri, Sharma, Kalia. Inorganic Chemistry. Unit-I,II,III,IV, V
4. Concise inorganic chemistry J.D.Lee. Unit-III,IV, V
5. Instrumental methods of chemical analysis H. Kaur. Unit-V
6. Chemistry for engineers by S.K.Jain, R.S. Thakure. Unit-V
7. Industrial chemistry by B. K. Sharma. 5^{th} Ed. Unit –V

Paper VIII: Organic Chemistry: MJBCT23- 402

Marks: 40 **Credits: 2**

Expected learning Outcomes:

Unit No.	Name of the Topic	Expected Learning Outcomes
I	Amines	Knowledge about Classification, Preparation, reactions and applications of amines.
II	Heterocyclic Compounds	To Impart the Knowledge of structure, synthesis and reactivity of heterocyclic compounds.
III	Organic Name Reactions and synthetic Reagents	Student will learn some organic reactions with mechanisms and applications of some reagents.
IV	Stereochemistry	Student will learn the basic knowledge of conformational analysis of some organic Compounds

Unit I: Amines (06L)

Amines (Aliphatic and Aromatic): (Upto 5 carbons) Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromide reaction. Reactions: Hofmann elimination, Carbylamine test, Hinsberg test, with HNO_2, Schotten – Baumann Reaction.

Unit II: Heterocyclic Compounds (08L)

Introduction, Classification, Pyrrole - method of synthesis, aromatic character, molecular orbital structure,resonance, reactivity, electrophilic substitution with mechanism, chemical reaction-reduction Nitration, sulphonation, Halogenation, friedal craft reaction, coupling reaction. Comparative study of pyrrol, furan and thiophene.

Unit III: Organic Name Reactions and Synthetic Reagents (10L)

Perkin reaction, Reformatsky Reaction, Knovengel Condensation, Claisen condensation, Mannich Reaction, Pinacole – Pinacolone Reaction, Clammensen Reduction, Reimer – Tiemann reaction. Synthetic Reagent- Aceto Acetic ester (Ethyl aceto acetate) and Grignard

Reagent.

Unit V: Stereochemistry (06L)

Nomenclature of Conformational isomers, Conformational analysis of Ethane and Butane, threo and erythro isomerism.

Reference Books: -

1) Chemistry for Degree student by R.L. Madan. Unit-I,II,III.

2) Organic chemistry by T.W. Graham Solman& Craig B. Fryhle – 9th Edition. Unit-I,II,III.

3) Organic Chemistry by Morrison & Boyd – 6th Edition. Unit-I,II,III,V,.

4) Organic Chemistry by Clayden, Greeves& Warren – 2nd Edition. Unit-I

5) Organic reaction mechanism - V. K. Ahluwalia, Rakesh Paruskar – 4th Edition. Unit-IV

6) Stereochemistry - P.S. Kalsi, D.Nasipuri,elien. Unit-V.

7) Stereochemistry of organic compounds – Elile. Unit-V.

8)Stereochemistry – Nasipuri. Unit-V.

Practical Course IV Code: MJBCP23-403

Inorganic Chemistry Section

Gravimetric Analysis:

a) Gravimetric estimation of iron as ferric oxide from the given solution of ferrous ammonium sulphate and free sulphuric acid

b) Gravimetric estimation of barium as barium sulphate from the given solution containing barium chloride and free hydrochloric acid.

1. Inorganic Preparations:

a) Preparation of ferrous ammonium sulphate (Mohr's salt)

b) Preparation of tetrammonium copper (II) sulphate

c) Preparation of chloropentammine cobalt (III) chloride

2. Titrimetric Estimations:

a) Determination of percentage purity of given sample of soda ash

b) Determination of total hardness of water using 0.01M EDTA solution

c) Determination on Percentage purity of tetramine copper (II) sulphate

3. Inorganic Semi-micro Qualitative Analysis :

Analysis of Inorganic binary mixture :

Anions: Cl^-, Br^-, NO_3^-, NO_2^-, SO_4^{--}, CO_3^{--}

Cations: Cd^{++}, Fe^{++}, Al^{+++}, Cr^{+++}, Zn^{++}, Mn^{++}, Co^{++} Mg^{++}, K^+, $NH4^+$, Ba^{++}, Cu^{++}

Learning Outcomes:

1. Students learn Gravimetric analysis.
2. Learn to standardize and to titrimetric estimations.
   a) Students learn inorganic semi- micro qualitative analysis..
   b) To find the purity of different inorganic samples.
   c) To study semi-micro Qualitative Analysis.

Organic Chemistry Section

Learning Objectives:

1. To study the analytical technique for structure determination of organic compound. .
2. To find the amount of different compounds.
3. To study qualitative analysis of organic compounds.

a) **Organic qualitative analysis: (Minimum 8 compounds)**

Acids: Salicylic acid, phthalic acid, aspirin, cinnamic acid, Succinic acid,

Oxalic acid, Phenol: β naphthol, P Nitro phenol, P Nitro phenol.

Base: P nitro aniline, O Nitro aniline, M Nitro aniline, diphenyl amine.

Neutrals: Acetamide, ethyl methyl Ketone, Acetophenone, Benzophenone, Benzaldehyde, methyl acetate, Chloro benzene, bromo benzene, Nitrobenzene, M- dinitrobenzene, naphthalene.

b) **Organic Estimations:**

   a) Estimation of Acetone
   b) Estimation of glycine
   c) Estimation of Vitamin C

c) **Organic Preparations: (any three)**

   d) Preparation of Benzoic acid
   e) Preparation of P – nitro acetanilide
   f) Preparation of Benzamide
   g) Preparation of Dihydropyrimidone
   h) Preparation of Dibenzalacetone (Green synthesis)

Learning Outcomes:

4. Students learn qualitative analysis of organic compounds
5. Students Learn to standardize and to estimate quantity of acetone, glycine etc
6. Students learn organic preparation and practical yield .Calculations of various organic compounds.

Practical References:

10. Experiments in chemistry- D.V.Jahagirdar Himalya publishing house
11. Vogel's text book of Qualitative Chemical Analysis (Longman ELBS Edition)
12. Vogel's text book of Quantitative Analysis (Longman ELBS Edition)
13. A Text Book of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis: A.I. Vogel (Third Ed.) (ELBS)
14. Practical maual in water analysis by Goyal and Trivedi
15. Basic concepts in Analytical chemistry by S.M.Khopkar
16. Practical Inorganic chemistry by Pass G.
17. Experimental Physical Chemistry by A. Findlay. *(Longman.)*
18. Advanced Practical Physical Chemistry by J.B. Yadav. *(Goel Publishing house, Meerut.)*
19. Experiments in Physical Chemistry by R. C. Das and B. Behra.*(Tata McGraw Hill.)*
20. Advanced experimental Chemistry Vol. I. Physical by J. N.Gurtu&R. Kapoor. *(S. Chand &Co.)*
21. Experiments in Physical Chemistry by J. C. Ghosh, *(BharatiBhavan.)*
22. Systematic Experimental Physical Chemistry – by S. W. Rajbhoj, Chondhekar. *(Anjali Publ.)*
23. Practical Physical Chemisty – by B. D. Khosala& V. C. Garg. R.*(S.Chand& Sons.)*

Experiments in Chemistry by D. V. Jahagirdar.

24. College Practical Chemistry by H. N. Patel, S. R. Jakali, H. P. Subhedar, Miss. S.P. Turakhia. *(Himalaya Publishing House, Mumbai.)*
25. Practical Physical Chemistry ,B .Vishwanathan and P.S.Raghvan

---

Rayat Shikshan Sanstha's

Sadguru Gadge Maharaj College, Karad

(Autonomous)

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

1. TITLE: B.Sc. Chemistry (Minor)
2. YEAR OF IMPLEMENTATION: 2024-25
3. PREAMBLE:

This updated syllabus is prepared for second year undergraduate students, to develop their interest towards chemistry and 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 yearof their graduation. The units in the syllabus are well defined with scope and the number of lectures. The references are mentioned with relevance.

4. GENERAL OBJECTIVES OF THE COURSE:
    1. The content of the syllabus have been framed as per the UGC norms.
    2. The students are expected to understand the fundamentals, principles, mathematical concepts and recent developments in the subject area.
    3. The practical course is in relevance to the theory courses to improve the understanding of the concepts.
5. DURATION: one year
6. PATTERN: Semester
7. MEDIUM OF INSTRUCTION: English

STRUCTURE OF COURSE:

9) OTHER FEATURES:

A) LIBRARY: Reference and Textbooks, Journals and Periodicals, Reference Books for Advanced Books for chemistry Advanced studies. –List Attached

B) SPECIFIC EQUIPMENTS: Necessary to run the Course, Computer, LCD, Projector, Visualizer, Smart board

C) LABORATORY EQUIPMENT'S: Apparatus, equipment's and chemicals required.

I) THIRD SEMESTER ---------(NO. OF PAPERS 1)

Paper V: Applied Chemistry I (MNBCT23-301)

Practical III: (MNBCP23- 302)

II) FOURTH SEMESTER --------(NO. OF PAPERS 1)

III) Paper VI: Applied Chemistry II (MNBCT23-401)

Practical IV: (MNBCP23-402) (Practical Examination is semester wise)

B.Sc. II Course Structure As Per NEP

Sem	DSC (Major)	DSE Minor-I)	AEC (Language)	Value added courses	SEC	IKS/CC/Sumer internship/OJT/FP	Total Credits
III	XYZ -V (2) XYZ -VI(2) Practical-III (4)	Applied Chemistry I- V (2) Practical-III (2)	English (2)	VAC-I (2) Democracy AEC-I (2) Environmental Sci.	SEC-II (2) SEC-III (2)	----------	22
IV	XYZ-III(2) XYZ-IV (2) Practical-IV (4)	Applied Chemistry II-VI (2) Practical-IV (2)	English (2)	AEC-II (2) Environmental Sci.	SEC-IV(2) SEC-V (2)	CC (2)	22
Total Credits	08 +08 =16	04 +04 =08	04	06	08	02	44

7) Examination Pattern:

Semester	Paper No.	Theory Exam. SEE	Internal Exam CCE	Total Marks
Semester III	Paper V (MNBCT23-301)	40	10	100
	Practical III (MNBCP23-302)	50	-	
Semester IV	Paper VI (MNBCT23-401)	40	10	100
	Practical IV (MNBCP23-402)	50	-	
Total				200

8) Credit System –

Semester	Paper No.	Name of Paper	Distribution of Marks		Total Marks	Credits
			SEE	CCE		
Semester III	Paper V (MNBCT23-301)	Applied Chemistry I	40	10	50	2
	Practical Examination III (MNBCP23- 302)	Practical III	50	-	50	2
Semester IV	Paper VI (MNBCT23-401)	Applied Chemistry II	40	10	50	2
	Practical Examination IV (MNBCP23- 402)	Practical IV	50	-	50	2
Total					200	08

9) Nature of Question Paper for Semester Pattern

Time: - 2 hrs. **Total Marks-40**

Instructions:

1. All questions are compulsory.
2. Numbers in right indicate full marks.
3. Use of scientific calculator is allowed.

Q. No.1) Multiple choice questions. (1 x 08) … (08)

Q.No.2) Attempt any two out of three (2 x 08) … (16)

Q.No.3) Attempt any four out of six (4 x 08) **……** (16)

Internal Examination

CCE-I: Marks =10

10) Practical Examination – Semester III

No. of Days-1 **Total Marks-50**

1) Physical Chemistry Experiment 20 marks

2) Analytical Chemistry Experiment 20 marks

3) Journal & Oral.....10 marks

Total = 50 marks.

11) Practical Examination – Semester IV

No. of Days-1 **Total Marks-50**

1) Inorganic Chemistry Experiment 20 marks

2) Organic Chemistry Experiment 20 marks

3) Journal & Oral.....10 marks

Total = 50 marks.

B.Sc. II Semester III

Paper V: Applied Chemistry I (MNBCT23-301)

Marks: 40

Subject	Unit No.	Title	Periods	Credits
Physical and Analytical Chemistry	I	Thermochemistry	08	2
	II	Distribution law	08	
	III	Basic concepts in industrial chemistry	08	
	IV	Soap and Detergents	06	
Grand total			30	

B.Sc. II Semester IV

Paper VI: Applied Chemistry (MNBCT23-401)

Marks: 40

Subject	Unit No.	Title	Periods	Credits
Inorganic and Organic Chemistry	I	Coordination Chemistry	10	2
	II	Bioinorganic Chemistry	06	
	III	Chemistry of Carbonyl Compounds	07	
	IV	Heterocyclic compounds	07	
Grand Total			30	

B.Sc. Part II: Chemistry

Semester III

Paper V: Applied Chemistry-I (MNBCT23-301)

Marks: 40 **Credits: 2**

Expected Learning Outcomes:

Unit No.	Name of the Topic	Expected Learning Outcomes
I	Thermochemistry	Learning and understanding application of first law of thermodynamics to chemical reactions.
II	Distribution law	Knowledge about distribution law and different of applications will be gained by students.
III	Basic concepts in industrial chemistry	Learning and understanding of the basic knowledge about industrial chemistry
IV	Soap and Detergents	Learning and understanding the knowledge about soap and detergents.

Unit I: Thermochemistry **[08 L]**

Important Principles and Definitions of thermochemistry, Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution, calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, variation of enthalpy of a reaction with temperature – Kirchhoff's equation.

Unit II: Distribution Law **[08 L]**

Introduction, Nernst's distribution law and its limitations, modifications of distribution law with respect to change in molecular state of solute, applications of distribution law (i) the process of extraction (ii) determination of solubility of solute in particular solvent (iii) distribution indicators (iv) determination of molecular weight of solute in different solvents.

Unit III: Basic concept in Industrial Chemistry [08 L]

Unit operation - Filtration, centrifugation, floatation, Evaporation, crystallization, adsorption,

Unit processes - Reduction, sulphonation, halogenation, nitration, polymerization

Unit IV: Soap and detergents [06 L]

Introduction, soap, manufacture of soap, Detergent or syndets, comparison between soap and detergents

References:

1. Principles of Chemistry by Puri and Sharma (Vishal Publishing Company,4th edition).
2. Essentials of Physical Chemistry by B. S. Bahl and G. D. Tuli. (S.Chand.). Unit-I,II,III,IV
3. A Text Book of physical Chemistry , by A.S.Negi and S.C. Anand, New Age International publ, 2nd Ed.
4. Advanced Physical Chemistry by Gurdeep Raj
5. Text Book of Physical Chemistry by K.L. Kapoor
6. Industrial chemistry by B. K. Sharma. Unit-V

Practical Course III MNBCP23: 302

Learning Objectives:

1. To study different instruments.
2. Students learn to operate viscometer and measures time of flow for liquids.
3. Measurement of refractive index and calculation of specific and molar refractivities.
4. Determines normality by titrations of strong acid Vs strong base

Note: 1. Use of Electronic / Analytical Balance is allowed.

2. Use of scientific calculator is allowed

Part [A] :Instrumental

1. Viscosity :

To determine the percentage composition of a given liquid mixture by viscosity method. (Density data to be given).

2. Refractometry :

To determine the specific and molar refractions of benzene, toluene and

xylene by Abbe's refractometer and hence determination of the refraction of -CH_2- group (Methylene group). (Densities should be determined by students.)

3. Conductometry:

1) Determination of cell constant of a conductivity cell using standard KCl (N/10 or N/50) solutions
2) To determine degree of dissociation and dissociation constant of acetic acid avarious dilutions and to verify Ostwald's dilution law conductometrically.
3) To determine the normality of the given strong acid by titrating it against strong alkali conductometrically.
4) To determine the normality of the given weak acid by titrating it against strong alkali conductometrically.

4. $_P$H metry:

1) Determination of $_P$H of given soil samples

5. Colorimetry

1) Determination of unknown concentration of potassium permanganate solution.

Part [B]: Non - Instrumental

4. Chemical Kinetics

1) To study the hydrolysis of methyl acetate in presence of HCl and H_2SO_4 and to determine the relative strength of acids.
2) To study the effect of acid strength (0.5 M and 0.25 M HCl) on hydrolysis of an ester.
3) To study the kinetics of the reaction between $K_2S_2O_8$ and KI in solution with unequal initial concentration of the reactants.
4) Determination of percentage purity of boric acid using supplied sodium hydroxide
5) Determination of titrable acidity in the given sample of milk or lassi of alkali content of antacid tablet using HCl.
6) Determination of percentage of nitrogen present in the given sample of nitrogenous fertilizer
7) Preparation of azo dye
8) Estimation of ester
09) Determination COD in water samples

Practical references:

1. Practical manual in water analysis by Goyal and Trivedi.
2. Basic concepts in Analytical chemistry by S.M.Khopkar
3. Experimental Physical Chemistry by A. Findlay. *(Longman.)*
4. Advanced Practical Physical Chemistry by J.B. Yadav. *(Goel Publishing house, Meerut.)*
5. Experiments in Physical Chemistry by R. C. Das and B. Behra.*(Tata McGraw Hill.)*
6. Advanced experimental Chemistry Vol. I. Physical by J. N.Gurtu&R. Kapoor. *(S. Chand &Co.)*
7. Experiments in Physical Chemistry by J. C. Ghosh, *(BharatiBhavan.)*
8. Systematic Experimental Physical Chemistry – by S. W. Rajbhoj, Chondhekar. *(Anjali Publ.*

Semester –IV

Paper VII: Applied Chemistry-II MNBCT23- 401

Marks: 40 **Credits: 2**

Expected Learning Outcomes:

Unit No.	Name of the Topic	Expected Learning Outcomes
I	Coordination Chemistry	Knowledge about Coordination compounds, Nomenclature, Werner's complexes, Isomerism.
II	Bioinorganic Chemistry	Students will understand Role of metal ions, metallo-porphyrins, alkali and alkaline earth metal ions.
III	Carbonyl Compounds: Aldehydes and Ketones	Student will learn the mechanisms and applications of organic reactions of carbonyl compounds.
IV	Heterocyclic Compounds	To Impart the Knowledge of structure, synthesis and reactivity of heterocyclic compounds.

Unit I: Coordination Chemistry (10 L)

1.1 Introduction

1.2 Distinction between double salt and complex salt

1.3 Definition and formation of co-ordinate covalent bond in BF3 -NH3,[NH4] +

1.4 Werner's theory: Postulates

The theory as applied to cobalt ammines viz. CoCl3.6NH3, CoCl3.5NH3, CoCl3.4NH3, CoCl3.3NH3.

1.5 Description of the terms: ligand, co-ordination number, co-ordination sphere

1.6 Effective atomic number

1.7 IUPAC nomenclature of coordination compounds.

1.8 Isomerism in complexes with C.N. 4 and 6

a) Geometrical Isomerism

b) Optical Isomerism

c) Structural Isomerism-Ionization Isomerism, Hydrate Isomerism, Coordination Isomerism, Linkage Isomerism and Co-ordination position Isomerism

1.8 Valance bond theory of transition metal complex with respect to

a) C.N. 4: complexes of Cu and Ni

b) C.N. 6 complexes of Fe and Co

Unit – II: Bioinorganic Chemistry [06 L]

2.1 Essential and trace elements in biological process

2.2 Metalloporphyrins with special reference to haemoglobin and myoglobin

2.3 Biological role of alkali and alkaline earth metal ions with special reference to Na^+, K^+ and Ca^{2+}.

Unit – III : Chemistry of Carbonyl Compounds [07L]

Introduction, Nomenclature of aliphatic and aromatic aldehydes and ketones. Structure and reactivity of Carbonyl group. Reactions of Carbonyl Compounds- Mechanism and applications of -----

i) Aldol condensation, ii) Claisen and Benzoin Condensation, iii) Perkins reaction, iv)

Cannizaros reaction, v) Knoevenagel condensation and vi) Reformatsky reaction.

Unit IV: Heterocyclic Compounds [07L]

Introduction, Classification, Pyrrole - method of synthesis, aromatic character, molecular orbital structure,resonance, reactivity, electrophilic substitution with mechanism, chemical reaction- reduction Nitration, sulphonation, Halogenation, friedal craft reaction, coupling reaction. Comparative study of pyrrol, furan and thiophene.

Reference Books:

1. Petrucci, R.H. *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York (1985).
2. Cotton, F.A.& Wilkinson, G. *Basic Inorganic Chemistry*, Wiley.
3. Puri, Sharma, Kalia. Inorganic Chemistry.
4. Concise inorganic chemistry J.D.Lee.
5. Instrumental methods of chemical analysis H. Kaur. Unit-V
6. Chemistry for Degree student by R.L. Madan.
7. Organic chemistry by T.W. Graham Solman& Craig B. Fryhle – 9th Edition.
8. Organic Chemistry by Morrison & Boyd – 6th Edition.

Practical Course IV Code: MNBCP23-402

Learning Objectives:

1. To study the analytical technique for structure determination of organic compound. .
2. To find the amount of different compounds.
3. To study qualitative analysis of organic compounds.

1.Gravimetric Analysis

a) Gravimetric estimation of iron as ferric oxide from the given solution of frrrous ammoniumsulphate and free sulphuric acid

b) Gravimetric estimation of barium as barium sulphate from the given solution containing barium chloride and free hydrochloric acid.

2. Inorganic Preparations:

a) Preparation of ferrous ammonium sulphate (Mohr's salt)

b) Preparation of tetrammonium copper (II) sulphate

c) Preparation of chloropentammine cobalt (III) chloride.

3.Titrimetric Estimations:

a) Determination of percentage purity of given sample of soda ash

b) Determination of total hardness of water using 0.01M EDTA solution

c) Determination on Percentage purity of tetramine copper (II) sulphate.

4.Inorganic Semi-micro Qualitative Analysis :

Analysis of Inorganic binary mixture :

Anions: Cl^-, Br^-, NO_3^-, NO_2^-, SO_4^{--}, CO_3^{--}

Cations: Cd^{++}, Fe^{++}, Al^{+++}, Cr^{+++}, Zn^{++}, Mn^{++}, Co^{++} Mg^{++}, K^+, $NH4^+$, Ba^{++}, Cu^{++}

1) **Organic qualitative analysis: (Minimum 8 compounds)**

Acids: Salicylic acid, pthalic acid, aspirin, cinnamic acid, Succinic acid,

Oxalic acid, Phenol: β napthol, P Nitro phenol, P Nitro phenol.

Base: P nitro aniline, O Nitro aniline, M Nitro aniline, diphenyl amine.

Neutrals: Acetomide, ethyl methyl Ketone , Acetophenone, Benzophenone, Benzaldehyde,

methyl acetate, Chloro benzene, bromo benzene, Nitrobenzene, M- dinitrobenzene, naphthalene, thiourea.

2) **Organic Estimation:**

   a) Estimation of Acetone

   b) Estimation of glycine

   c) Estimation of Vitamin C

3) **Organic Preparations: (any three)**
   a) Preparation of Benzoic acid
   b) Preparation of P – nitro acetanilide
   c) Preparation of Benzamide
   d) Preparation of Dihydropyrimidone
   e) Preparation of Dibenzalacetone (Green synthesis)

Learning Outcomes:

1. Students learn Gravimetric analysis.
2. Learn to standardize and to titrimetric estimations.
   f) Students learn inorganic semi- micro qualitative analysis..
   g) To find the purity of different inorganic samples.
   h) To study semi-micro Qualitative Analysis.

i) Students learn qualitative analysis of organic compounds

j) Students Learn to standardize and to estimate quantity of acetone, glycine etc

k) Students learn organic preparation and practical yield .Calculations of various organic compounds.

Practical References:

9. Experiments in chemistry- D.V.JahagirdarHimalya publishing house
10. Vogel's text book of Qualitative Chemical Analysis (Longman ELBS Edition)
11. Vogel's text book of Quantitative Analysis (Longman ELBS Edition)
12. A Text Book of Quantitative Inorganic Analysis Including Elementary

Instrumental Analysis: A.I. Vogel (Third Ed.) (ELBS)

13. Practical maual in water analysis by Goyal and Trivedi
14. Basic concepts in Analytical chemistry by S.M.Khopkar
15. Practical Inorganic chemistry by Pass G.
16. Experimental Physical Chemistry by A. Findlay. *(Longman.)*
17. Advanced Practical Physical Chemistry by J.B. Yadav. *(Goel Publishing house, Meerut.)*
18. Experiments in Physical Chemistry by R. C. Das and B. Behra.*(Tata McGraw Hill.)*
19. Advanced experimental Chemistry Vol. I. Physical by J. N.Gurtu&R. Kapoor. *(S. Chand &Co.)*
20. Experiments in Physical Chemistry by J. C. Ghosh, *(BharatiBhavan.)*
21. Systematic Experimental Physical Chemistry – by S. W. Rajbhoj, Chondhekar. *(Anjali Publ.)*
22. Practical Physical Chemisty – by B. D. Khosala& V. C. Garg. R.*(S.Chand& Sons.)*

Experiments in Chemistry by D. V. Jahagirdar.

23. College Practical Chemistry by H. N. Patel, S. R. Jakali, H. P. Subhedar, Miss. S.P. Turakhia.

(Himalaya Publishing House, Mumbai.)

24. Practical Physical Chemistry ,B .Vishwanathan and P.S.Raghvan

*** Note: Practical Examination will be conducted Semester wise.**

Sadguru Gadage Maharaj College,Karad
Department of Chemistry
SEC II
SECCT23-301
Basics of Soil and Water Analysis

.....

Marks: 50 **Credits: 2**

Unit –I Study of Water (15)

a. Hydrosphere- Water resources.
b. Properties of water- color, odor, turbidity, total salt content, total suspended water.
c. Water pollution- Definition of water pollution, types of water pollutants ,sources of water pollutants, trace element in water, water quality parameters and standards
d. Purification of water- Treatment of domestic and industrial water.

Unit –II Chemistry of Water (15)

a. Water Quality Parameters and Standards- Quality of drinking water, Quality of Irrigation water, COD, BOD,
b. Water Microbiology - TOC E-coli and total bacteria.
c. Sewage analysis

Unit –III Study of soil (15)

a. The structure of earth, Elemental composition of earth crust, Definition of soil.
b. Nature and classification of soil, important soil forming minerals, soil as eco system. soil fertility and productivity
c. Properties of soil – Colour, temperature, pH, electrical conductance (EC), water holding capacity, organic carbon, soil salinity, soil density.
d. Soil erosion- Definition, Control of erosion, Soil conservation practices, Soil pollution Causes and remedies.

Unit –IV Chemistry of Soil (15)

a. Soil health - Concept of nutrients, Micro and macro nutrients and it's relation to Plant, health and productivity.
b. Soil moisture- Maximum water holding capacity, field capacity, wetting point, available water capacity, soil water movement under saturated and unsaturated condition.
c. Problematic soils- Types of problematic soils, Classification, Management of problematic soils and reclamation of problematic soils, saline soils-Alkaline soils, acid soils and water logged soils.

References –

1. Analytical Chemistry-Alka Gupta (PragatiPrakashan)
2. Soil chemicals Analysis - P.R. Hesse
3.. Soil testing manual by department of agriculture and cooperation, India

Rayat Shikshan Sanstha's

Sadguru Gadage Maharaj College,Karad

Department of Chemistry

SEC III

SECCP23-302

Laboratory course in Soil and Water Analysis

. . . . . .

Syllabus

Paper II (practical/ Laboratory Visit)

Marks :50 **Credits: 2**

1. Collection of water samples (Field work)
2. Determination of total hardness of water
3. Determination of alkalinity of water
4. Determination of pH of water
5. Determination of conductivity of water
6. Determination of TDS in water
7. Collection of soil samples from fields and study of soil sampling tools. (Field work)
8. Soil sample preparation
9. Determination of maximum water holding capacity of soil
10. Determination of bulk density of soil
11 . Determination of pH of soil
12. Determination of conductivity of soil
13. Determination of moisture content in soil
14. Determination of Organic Carbon in soil
15. Determination of sulphate contents in soil

References –

1. Laboratory Mannual of Water and Wastewater Analysis, D.R. Khanna, R. Bhutiani, Daya Publishing House, Delhi, 2008
2. Chemical and Biological Methods for Water Pollution Studies, R.K. Trivedy, P.K.Goel, Oriental Printing Press, Aligarh, 1986
3. Practical Methods in Ecology and Environmental Science, R.K.Trivedy, P.K.Goel, C.L.Trishal, Environmental Publications,Karad (India) 1987
4. Analytical Chemistry-Alka Gupta (PragatiPrakashan)
5. Soil chemicals Analysis - P.R. Hesse
6. Soil testing manual by department of agriculture and cooperation, India

B.Sc. II Sem IV

SEC IV-Food Science and Technology

Course Code and title: SECC23-401

Credits: 02 **Total Lectures: 30**

Course Objectives:

- To learn about the Human diet.
- To provide technical steps for products.
- To provide knowledge of Food Safety and its Management
- Get the basics of food adulteration.
- Understand the adulteration process.
- Students will get the importance of human dietary sources.

Sr. No.	Topic	Lectures
1.	**Unit I - Supplementary foods**Introduction. Historical perspectives. Supplementary foods In India.Indian multipurpose food. Malt food, Bal Aahaar, Novel foods.	8
2.	**Unit II - Dairy Technology** Dairy – FSSA Definition of Milk, Types of Market Milk, Physico-chemical properties of milk, processing of Milk, Concept of Filtration, Pasteurization, Introduction to various Milk Products: Butter, ghee, flavored milk,yoghurt, dahi, shrikhand, icecream.	8
3.	**Unit III - Adulteration of common foods and methods of detection** Means of adulteration. Methods of detection of adulteration of milk, grain, spices etc.	7
4.	**Unit IV – Food Safety Management** Principles of food quality assurance, Total Quality Control (TQC) and Total Quality Management (TQM) in Food Industry.	7

Course Outcomes:

After completing the credits students should gain knowledge about:

- Understand the basics of Food Quality, Quality Control, Quality Assurance and FoodSafety.

- Understand the concept of Balanced Diets and plan nutritious meals for different age groups.
- Understand the basic procedures of detection of adulterants.

B.Sc. II Semester IV

SEC IV-Food Science and Technology

Lab Course Code and title: SECC23-402

Credits: 02 **Total Practical: 08**

Sr. No.	Name of the Experiment	Number of practical
1.	Preparation of banana / potato wafers.	01
2.	Preparation of fruit candy.	01
3.	Preparation of flavored milk.	01
4.	Preparation of Yogurt.	01
5.	Extraction and purification of Juice.	01
6.	Detection of adulterants in sugars / milk / oils	01
7.	Preparation of Lassi	01
8.	Preparation of popcorn.	01

References:

1. Carolyn D. Berdanier, Elaine B. Feldman and Johanna Dwyer. 2008. Handbook ofNutrition and Food, 2nd Ed. CRC Press, Boca Raton, FL, USA.
2. M. Swaminathan, Advanced Text-Book on Food &Nutrition (Vol-I&II), BangalorePrinting and Publishing Quantum Chemistry; By R. K. Prasad.
3. Food safety and standards act, 2006 By Bare ACT
4. H. Faride, 1997, The Science of Cookie and Cracker production, CBS Publication, New Delhi, 1997.