



**VIKRAMA SIMHAPURI UNIVERSITY**  
**NELLORE**

Date: 01-08-2022

**Minutes of Meeting and Resolutions**

Sub: Conducting of meeting for Board of Studies (UG) Chemistry from 2022-23-Regarding.


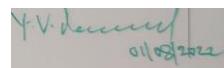
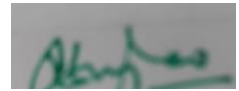
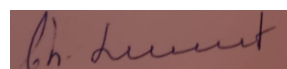
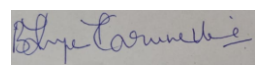
Ref: Vice-Chancellors orders Rc.No.VSU-CDC-Const.of BOS-2022-23.

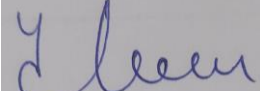
As per the directions of Vice-Chancellor of Vikrama Simhapuri University, Nellore, the Board of studies (UG) in Chemistry meeting was conducted on 01-08-2022 for the programs discussed the following agenda.

1. Approval of V Semester syllabus under CBCS pattern.
2. Modification of Syllabus (10%)
3. Model question papers
4. Industry and academic interaction

The following members are present for the BOS UG Chemistry meeting.

**Minutes of BOS of Chemistry 2022-2023**

S.No.	Capacity	Name of the personnel appointed	Whether Internal or External	Signature
1	Ex-officio member and Chairman	Dr.T.Raveendranath Babu Reader in Chemistry DKW Govt.Degree College, Nellore 9440506633	Chairman	
2	Ex-officio member Chairman of PG BOS	Prof.Y.V.Rami Reddy Dept.of Chemistry SV University, Tirupati 9440450108	External	
3	Members	Dr.KPPR Mohana Reddy Lecturer in Chemistry DKW Govt.Degree College Nellore 9441146812	Internal	K. P. P. R. Mohana Reddy
4		Smt.P.Sujana Lecturer in Chemistry Govt.Degree College Naidupet, 9491459357	Internal	
5		Dr.R.Srinivas Naidu Lecturer in Chemistry Govt.Degree College Naidupet, 9949619495	Internal	He is working at Andhra University
6		Dr.Ch.Subramanyam Sastry Lecturer in Chemistry SVSSC Govt.Degree College, Sullurpet 9292955175	Internal	
7		Smt.B.Krupa Karuna Vani Lecturer in Chemistry SKR Govt.Degree College	Internal	

		Gudur 8184835219		
8		Mr.Yellu Praveen Senior trainer Adani Saksham Krishna Patnam9703803880	Industry Expert	



## VIKRAMA SIMHAPURI UNIVERSITY :: NELLORE

REVISED UG SYLLABUS UNDER CBCS  
(Implemented from Academic Year, 2020-21)  
PROGRAMME: FOUR YEAR B.Sc.(Hons)  
Domain Subject: **CHEMISTRY**

*Skill Enhancement Courses (SECs) for Semester V, from 2022-23 (Syllabus with Learning Outcomes, References, Co-curricular Activities & Model Q.P. Pattern)*

### Structure of SECs for Semester-V

*(To choose One pair from the Five alternate pairs of SECs)*

Univ. Code	CourseNO. 6&7	Name of Course	Th.Hrs / Week	IE Mar-ks	EE Mar-ks	Credits	Prac. Hrs. / Wk	Mar-ks	Credits
	6A	Synthetic Organic Chemistry	3	25	75	3	3	50	2
	7A	Analysis of Organic Compounds	3	25	75	3	3	50	2

OR

	6B	Analytical Methods in Chemistry-1	3	25	75	3	3	50	2
	7B	Analytical Methods in Chemistry-1	3	25	75	3	3	50	2

OR

	6C	Industrial Chemistry-1	3	25	75	3	3	50	2
	7C	Industrial Chemistry-2	3	25	75	3	3	50	2

OR

	6D	Environmental Chemistry	3	25	75	3	3	50	2
	7D	Green Chemistry and Nanotechnology	3	25	75	3	3	50	2

OR

	6E	Analytical Methods in Chemistry	3	25	75	3	3	50	2
	7E	Cosmetics and Pharmaceutical Chemistry	3	25	75	3	3	50	2

**Note-1:** For Semester–V, for the domain subject Chemistry, any one of the five pairs of SECs shall be chosen as courses 6 and 7, i.e., 6A&7A or 6B&7B or 6C&7C or 6D&7D or 6E&7E. The pair shall not be broken (ABC allotment is random, not on any priority basis).

**Note-2:** *One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented. Hence, teachers shall also impart practical training to students on the skills embedded in syllabus citing related real field situations.*

## Semester-wise Revised Syllabus under CBCS, 2020-21

Four-year B.Sc.(Hons)

Domain Subject:

Course Code:

**CHEMISTRY**

IV Year B.Sc.(Hons) –Semester–V

Max Marks: 100+50

**Course6-A: Synthetic Organic Chemistry**

(Skill Enhancement Course (Elective), Credits: (05))

**I. Learning Outcomes:**

Students after successful completion of the course will be able to:

1. Identify the importance of reagents used in the synthesis of organic compounds.
2. Acquire knowledge on basic concepts in different types of pericyclic reactions.
4. Understand the importance of retro synthesis in organic chemistry.
5. Comprehend the applications of different reactions in synthetic organic chemistry.

**II. Syllabus :** ( Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)**Unit-1: Per cyclic reactions****12 hours**

1. A brief introduction to synthetic organic chemistry
2. Features and classification of per cyclic reactions: Phases, nodes and symmetry properties of molecular orbital's in ethylene, 1, 3-butadiene. Thermal and photochemical reactions.
3. Electro cyclic reactions: Definition and examples, definitions of con and dis rotation, Woodward- Hoffmann selection rules.(Correlation diagrams are not required)
4. Cyclo addition reactions: Definition and examples, definitions of supra facial and an tar facial addition, Woodward- Hoffmann selection rules. (Correlation diagrams are not required)

**Unit-2: Organic photochemistry****8hours**

1. Jablonski diagram-singlet and triplet states
2. Photochemistry of Carbonyl compounds- $n-\pi$  and  $\pi-\pi^*$  transitions, Norrish type-1 and type-2 reactions
3. Paterno – Buchi reaction.

**Unit-3: Retro synthesis****12 hours**

1. Important terms in Retro synthesis with examples-Disconnection, Target molecule, FGI, Synthons, Retro synthetic analysis, chemo selectivity, region selectivity
2. Importance of Order of events in organic synthesis
3. Retro synthetic analysis of the compounds: a. cyclohexene, b. 4-Nitro toluene, c. Paracetamol.

**Unit-4: Synthetic Reactions****8hours**

Shapiro reaction, Stork - enamine reaction (only alkylation), Wittig reaction, Robinson annulation, Heck reaction, Suzuki coupling. Synthesis of aldehydes and ketones using 1,3-Dithiane.

**Unit-5: Reagents in Organic Chemistry****10 hours**

Oxidizing agents: PCC, PDC, SeO<sub>2</sub> (Riley oxidation), NBS.

Reducing agents: LiAlH<sub>4</sub> (with mechanism), LTBA, Metal-solvent reduction (Birch reduction), Catalytic reduction.

**III. References**

1. Peri cyclic reactions by Ian Fleming, Second edition, Oxford University press.
2. Peri cyclic Reactions-A Text book: Reactions, Applications and Theory by S.Sankararaman, WILEY-VCH.
3. Reaction Mechanism in Organic Chemistry by S.M. Mukherji and S.P.Singh, Revised edition, Trinity Press.
4. Pericyclic reactions-A Mechanistic study by S.M.Mukherji, Macmillan India.
5. Organic synthesis: The disconnection approach by Stuart Warren, John Wiley & Sons.
6. Organic chemistry by Jonathan Clayden, Nick Greeves and Stuart Warren, Second edition, Oxford university press.
7. Reactions, Reagents and Rearrangements by S.N. Sanyal, Bharati Bhawan Publishers & Distributors.

## Course6-A: Synthetic Organic Chemistry-PRACTICAL SYLLABUS

### IV. Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Perform the organic qualitative analysis for the detection of N, S and halogens using the green procedure.
2. Learn the procedure for the separation of mixture of amino acids using paper chromatography.
3. Prepare the TLC plates for TLC chromatography.
4. Acquire skills in conducting column chromatography for the separation of dyes in the given mixture.

### V. Practical (Laboratory) Syllabus :(30hrs)

(Max.50 Marks)

1. Green procedure for organic qualitative analysis: Detection of N, S and halogens
2. Separation of given mixture of amino acids (glycine and phenyl alanine) using ascending paper chromatography.
3. Separation of a given dye mixture (methyl orange and methylene blue) using TLC (using alumina as adsorbent).
4. Separation of mixture of methyl orange and methyl blue by column chromatography
5. Separation of food dyes using Column Chromatography
6. Separation of triglycerides using TLC

### VI. Lab References:

1. Vogel A. I. Practical Organic Chemistry, Longman Group Ltd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
3. Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, University press.
4. Mann F. G and Saunders B.C, Practical Organic Chemistry, Pearson Education.

### VII. Co-Curricular Activities

**a) Mandatory:** (Lab/field training of students by teacher: (lab: 10+field:05):

1. **For Teacher:** Training of students by the teacher in laboratory and field for not less than 15 hours on the field techniques/skills of detection of N, S and halogens using the green procedure, preparation of TLC plates, detection of organic compounds using  $R_f$  values in TLC/ paper chromatography, loading of column, selection of solvent system for column chromatography, separation of amino acids and dye mixture using chromatographic techniques.
2. **For Students:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the synthetic reactions. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
4. Unit tests (IE).

**b) Suggested Co-Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of relevant videos and material.
3. Visits of abilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

**VIII. Suggested Question Paper Pattern:****Model Paper****Chemistry Course 6-A Synthetic Organic Chemistry****Time : 3 Hours****Max. Marks : 75****PART – A****Answer any FIVE of the following questions.****Each carries FIVE marks.****5 x 5 = 25 Marks**

1. Explain Woodward – Hoffmann selection rules.
2. Write down classification of Pericyclic reaction.
3. Discuss Paterno Buchi reaction.
4. Write down Photo chemistry of Carbonyl compounds.
5. Discuss Retro synthetic analysis of cyclohexene.
6. Write down important terms in Retro synthesis with example.
7. Write down mechanism of Suzuki coupling reaction.
8. Write down witting reaction.
9. Explain Birch reduction.
10. Write down  $\text{SeO}_2$  oxidizing property.

**PART – B****Answer any FIVE of the following questions.****Each carries TEN marks.****5 x 10 = 50 Marks**

11. Write down Thermal and photo chemical reactions.
12. Explain the Molecular orbitals in Ethylene and 1, 3 – Butadiene.
13. Write down Norrish Type – I and Norrish Type – II reactions.
14. Explain Jablonski diagram.
15. Write down Importance of order of Events in organic synthesis.
16. Explain Chemoslectivity, Region selectivity.
17. Write down mechanism of Shapiro reaction and Stork – enamine reaction.
18. Write down synthesis of Aldehydes and Ketones using 1, 3 – Dithiane.
19. Explain importance of  $\text{LiAlH}_4$  reagent.
20. Explain PCC, PDC reaction.

**NOTE : For paper setters choosing the two Short Questions and two Long Questions  
for Each unit.**



## Semester-wise Revised Syllabus under CBCS, 2020-21

Four-year B.Sc. (Hons)

Course Code:

Domain Subject:

**CHEMISTRY**

IV Year B.Sc.(Hons) –Semester–V

Max Marks: 100+50

**Course7-A: Analysis of Organic Compounds**

(Skill Enhancement Course (Elective), Credits: 05)

**I. Learning Outcomes:**

Students after successful completion of the course will be able to:

1. Identify the importance of mass spectrometry in the structural elucidation of organic compounds.
2. Acquire the knowledge on structural elucidation of organic compounds.
3. Understand various chromatography methods in the separation and identification of organic compounds.
4. Demonstrate the knowledge gained in solvent extraction for the separate the organic compounds.

**II. Syllabus :** ( Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)**Unit-1: Mass Spectrometry****10 hours**

A brief introduction to analysis of organic compounds

Basic principles, Instrumentation - Mass spectrometer, electron Ionization (Electron Impact ionization, EI), Molecular ions, metastable ions, Isotope abundance. Basic fragmentation types. Fragmentation patterns in Toluene, 2-Butanol.

**Unit-2: Structural elucidation of organic compounds using IR, NMR, mass spectral data-****8 hours**

2, 2, 3, 3-Tetra methyl butane, Butane-2, 3-dione, Prop ionic acid and methyl propionate.

**Unit-3: Structural elucidation of organic compounds using IR, NMR, Mass spectral data-****8 hours**

Phenyl acetylene, ace to phenomenon acetic acid and p-nitro aniline.

**Unit-4: Separation techniques-1****12 hours**

1. Solvent extraction-Principle and theory, Batch extraction technique, application of batch extraction.
2. Chromatography- Principle and theory, classification, types of adsorbents,  $R_f$  values and factors affecting  $R_f$  values.
3. Thin layer chromatography-principle, experimental procedure, advantages and applications.

**Unit-5: Separation techniques-2****12 hours**

1. Paper chromatography- Principle, experimental procedure, ascending, descending, radial and two dimensional, applications.
2. Column chromatography-Principle, classification, experimental procedure, applications.
3. HPLC-Principle, Instrumentation-block diagram and applications.

**III. References**

1. Organic Spectroscopy by William Kemp, Third Edition, Palgrave USA.
2. Introduction to Spectroscopy by Pavia, Lampman, Kriz and Vyvyan, Fifth edition, Cengage.
3. Organic Spectroscopy: Principles and Applications by Jag Mohan, Second edition, Alpha Science.
4. Spectator's copy of Organic Compounds by P.S.Kalsi, Seventh edition, New Age International.
5. Spectroscopic Methods in Organic Chemistry by Ian Fleming and Dudley Williams, Seventh edition, Springer.
6. Fundamentals of Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M.West and Douglas A.Skoog, Ninth edition, Cengage.
7. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and Kevin A.Schug, Seventh edition, Wiley.
8. Quantitative analysis by R.A.Day Jr. and A.L.Underwood, Sixth edition, Pearson.
9. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

## **Course7-A: Analysis of Organic Compounds - PRACTICAL SYLLABUS**

### **IV. Learning Outcomes:**

On successful completion of this practical course, student shall be able to:

1. Prepare acetanilide using the green synthesis.
2. Demonstrate the preparation of azodye.
3. Acquire skills in the separation of organic compounds in the given mixture using solvent extraction

### **V. Practical (Laboratory) Syllabus:(30hrs)**

(Max.50 Marks)

1. Identification of various equipment in the laboratory.
2. Acetylation of 1<sup>o</sup> amine by green method: Preparation of acetanilide
3. Rearrangement reaction in green conditions: Benzil - Benzilic acid rearrangement
4. Radical coupling reaction: Preparation of 1,1-bis -2-naphthol
5. Green oxidation reaction: Synthesis of adipic acid
6. Preparation and characterization of biodiesel from vegetable oil/ waste cooking oil
7. Photo reduction of Benzophenone to Benzopinacol in the presence of sunlight.
8. Separation of organic compounds in a mixture (acidic compound + neutral compound) using solvent extraction.
9. Separation of organic compounds in a mixture (basic compound +neutral compound) using solvent extraction.

### **VI. Lab References:**

1. Vogel A. I. Practical Organic Chemistry, Longman Group Ltd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
3. Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, University press.
4. Mann F.G and Saunders B.C, Practical Organic Chemistry, Pearson Education.

### **IV. Co-Curricular Activities:**

**a) Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):**

5. **For Teacher:** Training of students by teacher in laboratory and field for not less than 15 hours on the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.
6. **For Student:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a handwritten fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
7. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
5. Unit tests (IE).

### **b) Suggested Co-Curricular Activities**

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of videos and other

material.

3. Visits of facilities, firms, research organizations etc.

4. Invited lectures and presentations on related topics by field/industrial experts.

**VIII. Suggested Question Paper Pattern:****Model Paper****Chemistry Course 7-A Analysis of Organic Compounds****Time : 3 Hours****Max. Marks : 75**

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**PART – A****Answer any FIVE of the following questions.****Each carries FIVE marks.****5 x 5 = 25 Marks**

1. What are molecular ions and meta stable ions with examples.
2. Explain Basic Fragmentation types.
3. Write down structural elucidation of propionic acid using NMR and mass spectral data.
4. Explain structural elucidation of Methyl propionate using NMR and mass spectral data.
5. Write down structural elucidation of phenyl acetylene using IR, NMR and mass spectral data.
6. Write down structural elucidation of Acetophenone using IR, NMR and mass spectral data.
7. Define  $R_f$ . Write down factors affecting  $R_f$  value.
8. Write down advantages and application of TLC.
9. Draw the Instrumentation of HPLC.
10. Explain principle and applications of column chromatography.

**PART – B****Answer any FIVE of the following questions.****Each carries TEN marks.****5 x 10 = 50 Marks**

11. Write down Basic principles and Instrumentation of Mass spectro photometer.
12. Explain Fragmentation patterns in Toluene and 2 – Butanol.
13. Explain structural elucidation of 2, 2, 3, 3 – Tetra methyl butane by using IR, NMR and mass spectral data.
14. Explain structural elucidation of Butane 2, 3 – dione by using IR, NMR and mass spectral data.
15. Explain structural elucidation of acetic acid using IR, NMR and mass spectral data.
16. Explain structural elucidation of P – Nitro aniline using IR, NMR and mass spectral data.
17. Define solvent extraction. Write down Batch extraction.
18. Define chromatography. Write down different types of classification of chromatography.
19. Write down principle, procedure and applications of paper chromatography.
20. Write down Ascending, Descending and Radial chromatograms in paper chromatography.

**NOTE: For paper setters choosing the two Short Questions and two Long Questions****for Each unit.**

## Semester-wise Revised Syllabus under CBCS, 2020-21

Four-year B.Sc. (Hons)  
 Domain Subject: **CHEMISTRY**  
 IV Year B.Sc.(Hons)–  
 Semester–V

Course Code:

Max Marks: 100+50

**Course6-B: Analytical Methods in Chemistry-1**

(Skill Enhancement Course (Elective), Credits: 05)

**I. Learning Outcomes:**

Students after successful completion of the course will be able to:

1. Identify the importance of solvent extraction and ion exchange method.
2. Acquire knowledge on the basic principles of volumetric analysis and gravimetric analysis.
3. Demonstrate the usage of common laboratory apparatus used in quantitative analysis.
4. Understand the theories of different types of titrations.
5. Gain knowledge on different types of errors and their minimization methods.

**II. Syllabus:***(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)***Unit-1: Quantitative analysis-1****8 hours**

1. A brief introduction to analytical methods in chemistry
2. Principles of volumetric analysis, concentration terms- Molarity, Normality, preparing solutions- Standard solution, primary standards and secondary standards.
2. Description and use of common laboratory apparatus- volumetric flask, burette, pipette, beakers, measuring cylinders.

**Unit-2: Quantitative analysis-2****12hours**

1. Principles of volumetric analysis: Theories of acid-base (including study of acid-base titration curves), redox, complex metric, iodometric and precipitation titrations- choice of indicators for the saturations.
2. Principles of gravimetric analysis: precipitation, co precipitation, post precipitation, digestion, filtration, and washing of precipitate, drying and ignition.

**Unit-3: Treatment of analytical data****8hours**

Types of errors- Relative and absolute, significant figures and its importance, accuracy - methods of expressing accuracy, precision-methods of expressing precision, standard deviation and confidence interval.

**Unit-4: separation techniques****12 hours**

1. Solvent Extraction: Introduction, principle, factors affecting solvent extraction, Batch extraction, continuous extraction and counter current extraction. Application- Determination of Iron (III).
2. Ion Exchange method: Introduction, applications.

**UNIT-5: Analysis of water****10hours**

Determination of dissolved solids, total hardness of water, turbidity, alkalinity, Dissolvedoxygen, COD, determination of chloride using Mohr's method.

**III. References**

1. Fundamentals of Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M.Westand Douglas A.Skoog, Ninth edition, Cengage.
2. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and KevinA.Schug,Seventh edition, Wiley.
3. Quantitative analysis by R.A.DayJr. And A.L.Underwood, Sixth edition, Pearson.
4. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
5. Text book of Environmental Chemistry and Pollution Control by S.S.Dara and D.D.Mishra, Revised edition, S Chand & CoLtd.

### **Course6-B: Analytical methods in chemistry-1-PRACTICALSYLLABUS**

#### **IV. Learning Outcomes:**

On successful completion of this practical course, student shall be able to:

1. Estimate Iron(II) using standard Potassium dichromate solution
2. Learn the procedure for the estimation of total hardness of water
3. Demonstrate the determination of chloride using Mohr's method
4. Acquire skills in the operation and calibration of pH meter
5. Perform the strong acid vs strong base titration using pH meter

#### **V. Practical (Laboratory)Syllabus:(30hrs)**

(Max.50 Marks)

1. Estimation of Iron(II) using standard Potassium dichromate solution (using DPA indicator)
2. Estimation of total hardness of water using EDTA
3. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.
4. Preparation of buffer solutions of different pH (i) Sodium acetate-acetic acid, (ii) Ammonium chloride-ammonium hydroxide.
5. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.

#### **VI. Lab References:**

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

#### **VII. Co-Curricular Activities:**

**a) Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):**

8. **For Teacher:** Training of students by the teacher in laboratory and field for not less than 15 hours on the field techniques/skills of calibration of pH meter, Strong acid vs strong base titration using pH meter, determination of chloride ion, estimation of water quality parameters and estimation of Iron(II).
9. **For Student:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe various methods used for the analysis of water. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
10. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
5. Unit tests (IE).

#### **b) Suggested Co-Curricular Activities**

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.



**VIII. Suggested Question Paper Pattern:****Model Paper****Chemistry Course 6-B Analytical methods in Chemistry - 1****Time : 3 Hours****Max. Marks : 75**

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**PART – A****Answer any FIVE of the following questions.****Each carries FIVE marks.****5 x 5 = 25 Marks**

1. Write down brief Introduction to analytical methods in chemistry.
2. How is prepared primary and secondary standard solutions.
3. Explain choice of Indicators for Titrations.
4. Write down precipitation Titrations.
5. Explain types of Errors.
6. Define Accuracy. Write down methods of expressing Accuracy.
7. Write down factors affecting solvent extraction.
8. Explain counter current extraction technique.
9. Write down COD.
10. Write down total hardness of water.

**PART – B****Answer any FIVE of the following questions.****Each carries TEN marks.****5 x 10 = 50 Marks**

11. Write down principles of volumetric analysis and also explain Molarity and Normality concentrations terms.
12. Describe and use of common laboratory apparatus like volumetric flask, Burette, pipette and Beakers.
13. Explain principles involved in Gravimetric analysis.
14. Explain Theories of Acid – Base Indicators.
15. What are significant figures. Write down its Importance.
16. Write note on standard deviation and confidence Interval.
17. Explain Introduction and applications of Ion – Exchange method.
18. Define solvent extraction. Explain Batch extraction.
19. Write down determination of chloride using Mohr's method.
20. Explain determination of dissolved solids, turbidity and alkalinity of water samples.

**NOTE : For paper setters choosing the two Short Questions and two Long Questions****for Each unit.**

## Semester-wise Revised Syllabus under CBCS, 2020-21

Four-year B.Sc. (Hons)

Domain Subject:

**CHEMISTRY**

IV Year B.Sc.(Hons)–Semester–V

Course Code:

Max Marks: 100+50

**Course7-B: Analytical Methods in Chemistry-2**

(Skill Enhancement Course (Elective), Credits: 05)

**I. Learning Outcomes:**

Students after successful completion of the course will be able to:

1. Identify the importance of chromatography in the separation and identification of compounds in a mixture
2. Acquire a critical knowledge on various chromatographic techniques.
3. Demonstrate skills related to analysis of water using different techniques.
4. Understand the principles of spectro chemistry in the determination of metal ions.
5. Comprehend the applications of atomic spectroscopy.

**II. Syllabus :** ( Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)**Unit-1: Chromatography-Introduction and classification****10 hours**Principle, Classification of chromatographic methods, Nature of adsorbents,  $R_f$  values, factors affecting  $R_f$  values.**UNIT-2: TLC and paper chromatography****12 hours**

1. Thin layer chromatography: Principle, Experimental procedure, preparation of plates, adsorbents and solvents, development of chromatogram, detection of spots, applications and advantages.
2. Paper Chromatography: Principle, Experimental procedure, choice of paper and solvents, various modes of development- ascending, descending, radial and two dimensional, applications.

**UNIT-3: Column chromatography****12 hours**

1. Column chromatography: Principle, classification, Experimental procedure, stationary and mobile phases, development of the Chromatogram, applications.
2. HPLC: Basic principles, instrumentation –block diagram and applications.

**UNIT-4: Spectrophotometry****8 hours**Principle, Single beam and double beam spectrometer, Beer- Lambert's law- Derivation, applications of Beer- Lambert's law-Quantitative determination of  $Fe^{+2}$  and  $Mn^{+2}$ .

**UNIT-5: Atomic spectroscopy****8hours**

Types, atomizer, atomic absorption and emission and applications.

**III. References**

1. Fundamental so Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M.Westand Douglas A.Skoog, Ninth edition, Cengage.
2. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and Kevin A.Schug, Seventh edition, Wiley.
3. Quantitative analysis by R.A.Day Jr. and A.L.Underwood, Sixth edition, Pearson.
4. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition/ Pearson.

## Course7-B: Analytical Methods in Chemistry-2- PRACTICAL SYLLABUS

### V. Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Perform the separation of a given dye mixture using TLC
2. Learn the preparation of TLC plates
3. Demonstrate the separation of mixture of amino acids using paper chromatography
4. Acquire skills in using column chromatography for the separation of dye mixture

### VI. Practical (Laboratory) Syllabus: (30hrs) (Max.50Marks)

1. Separation of mixture of methyl orange and methylene blue by column chromatography.
2. Separation of given mixture of amino acids (glycine and phenyl alanine) using ascending paper chromatography.
3. Separation of food dyes using Column Chromatography
4. Separation of triglycerides using TLC
5. Verification of Beer Lambert's law. (Using potassium permanganate solution) using colorimeter /spectrophotometer.

### VII. Lab References:

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
1. Vogel A. I. Practical Organic Chemistry, Longman Group Ltd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley- Eastern.
3. Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, University press.
4. Mann F.Gand Saunders B.C, Practical Organic Chemistry, Pearson Education.

### VII. Co-Curricular Activities:

**a) Mandatory:**(Lab/field training of students by teacher ( lab:10+field:05):

**11. For Teacher:** Training of students by the teacher in laboratory and field for not less than 15 hours on the field techniques/skills of determination of hardness of water, using the calorimeter and or Spectrophotometer, preparation of TLC plate, identification of spots in TLC and Paper chromatographic techniques, loading of column, selection of solvent system, separation of amino acids and dyes mixture using chromatographic techniques.

**12. For Student:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the chromatographic techniques used for the separation of compounds. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.

**13.** Max marks for Fieldwork/project work Report: 05.

**4.** Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*

10. Unit tests (IE).

**b) Suggested Co-Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

**VIII. Suggested Question Paper Pattern:****Model Paper****Chemistry Course 7-B Analytical methods in Chemistry-2****Time : 3 Hours****Max. Marks : 75****PART – A****Answer any FIVE of the following questions.****Each carries FIVE marks.****5 x 5 = 25 Marks**

1. Define  $R_f$ . Write down factors affecting  $R_f$  values.
2. What are Nature of adsorbents in chromatography.
3. Write down applications and advantages in TLC.
4. Explain one dimensional and two dimensional paper chromatography.
5. Write down applications of column chromatography.
6. Draw the block diagram of HPLC.
7. Derive Beer – Lambert's Law.
8. Explain principle of spectrophotometry.
9. Write note on Atomizer.
10. Explain types of Atomic spectroscopy.

**PART – B****Answer any FIVE of the following questions.****Each carries TEN marks.****5 x 10 = 50 Marks**

11. Write down classification of chromatographic methods.
12. Define Chromatography. Write down principle of Chromatography.
13. Write down principle, experimental procedure and applications of paper chromatography.
14. Explain principle and experimental procedure for TLC.
15. Write down principle and experimental procedure for column chromatography.
16. Explain Basic principle and applications of HPLC.
17. Write down applications of Beer – Lambert's Law for Quantitative determination of  $Fe^{+2}$  &  $Mn^{+2}$ .
18. Explain Single and Double beam spectrometers.
19. Write down Atomic absorption and Emission in Atomic spectroscopy.
20. Write down applications of Atomic spectroscopy.

**NOTE : For paper setters choosing the two Short Questions and two Long Questions****for Each unit.**

## Semester-wise Revised Syllabus under CBCS, 2020-21

Four-year B.Sc. (Hons)  
 Domain Subject: **CHEMISTRY**  
 IV Year B.Sc.(Hons)–  
 Semester–V

Course Code:

Max. Marks : 100+50

**Course6-C: Industrial Chemistry-1**

(Skill Enhancement Course (Elective), Credits: 05)

**I. Learning Outcomes:**

Students after successful completion of the course will be able to:

1. Identify the importance of different surface coatings.
2. Acquire a critical knowledge on manufacture of ceramics and cement.
3. Understand various steps in the manufacture of cane sugar.
4. Explain the manufacture of pulp and paper.

**II. Syllabus** : ( Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)**Unit-1: Fertilizers****10 hours**

A brief introduction to industrial chemistry

Different types of fertilizers. Manufacture of the following fertilizers: Urea, Ammonium nitrate, Calcium ammonium nitrate, Ammonium phosphates; Polyphosphate, Superphosphate, Compound and mixed fertilizers.

**Unit-2: Silicates****10hours**

1. **Ceramics**: Important clays and Felds par. Ceramics-types, uses and manufacture. High technology ceramics and their applications.

2. **Cements**: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

**Unit-3: Surface Coatings****12 hours**

Objectives of coatings surfaces, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, modified oils, Pigments, toners and lake pigments, fillers, thinners, enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Water and Oil paints.

**Unit-4: Sugar Chemistry****08hours**

Introduction–Manufacture and recovery of cane sugar from molasses, manufacture of sucrose from beat root, testing and estimation of sucrose.

**Unit-5: Paper Industry****10hours**

**Pulp and Paper**-Introduction, Manufacture of pulp, sulphate or Kraft pulp, soda pulp, sulphite pulp, rag pulp, beating, refining, filling, sizing and colouring of pulp, manufacture of paper.

**III. References:**

1. E.Stocchi: *Industrial Chemistry*, Vol-I, Ellis HorwoodLtd.UK
2. J.A.Kent: *Riegel's Hand book of Industrial Chemistry*, CBS Publishers, New Delhi.
3. P.C.Jain, M.Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
4. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry*, Vikas Publications, NewDelhi.
5. B.K.Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut
6. O. P. Vermani, A. K. Narula: *Industrial Chemistry*, Galgotia Publications Pvt. Ltd., New Delhi.

**Course6 C: Industrial Chemistry-1- PRACTICAL SYLLABUS****IV. Lab work-Skills Outcomes:**

On successful completion of this practical course, student shall be able to:

1. Determine free acidity in ammonium sulphate fertilizer.
2. Learn the procedure for the Estimation of Calcium in Calcium ammonium nitrate fertilizer.
3. Demonstrate skills on Estimation of phosphoric acid in superphosphate fertilizer.
4. Acquire skills in using colorimetry for the estimation of sucrose.

**V. Practical(Laboratory)Syllabus:(30hrs)**

(Max.50 Marks)

1. Determination of free acidity in ammonium sulphate fertilizer.
2. Estimation of Calcium in Calcium ammonium nitrate fertilizer.
3. Estimation of phosphoric acid in superphosphate fertilizer.
4. Estimation of sucrose by colorimetry.

**VI: Lab References**

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
2. Text book on Experiments and Calculations in Engineering Chemistry, S.S.Dara, S.Chand.
3. R.Gopalan, D.Venkappayya, S.Nagarajan: *Engineering Chemistry*, Vikas Publications.
4. B.K.Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut

**VII. Co-Curricular Activities:**

**a) Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):**

1. **For Teacher:** Training of students by the teacher in laboratory and field for not less than15 hours on field related skills in determination of free acidity, estimation of calcium and phosphoric acid in a fertilizer, use of colorimeter to estimate sucrose.
2. **For Student:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the surface coatings of surfaces used to prevent the corrosion. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, indexpage, details of place visited, observations, findings, and acknowledgements.*
5. Unit tests (IE).

**b) Suggested Co - Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.



### VIII. Suggested Question Paper Pattern:

**Model Paper**  
**Chemistry Course 6-C Industrial Chemistry - I**

Time : 3 Hours

Max. Marks : 75

**PART – A**

**Answer any FIVE of the following questions.**

**Each carries FIVE marks.**

**5 x 5 = 25 Marks**

1. What are mixed fertilizers.
2. Write note on Superphosphate fertilizer.
3. What are Ingredients in cements.
4. Explain different types of Ceramics.
5. Write note on water and oil paints.
6. Explain classification of surface coatings.
7. Write note on estimation of sucrose.
8. Define sugar and molasses.
9. Write note on soda pulp ; sulphite pulp.
10. Explain the following :
  - a) Refining
  - b) Beating
  - c) filling

**PART – B**

**Answer any FIVE of the following questions.**

**Each carries TEN marks.**

**5 x 10 = 50 Marks**

11. Write down different types of fertilizers.
12. Write down manufacture of urea and Ammonium nitrate fertilizer.
13. Write down importance of clays and feldspar.
14. Explain the classification cement.
15. Explain the following :
  - a) Eco – friendly paint
  - b) Heat retardant paint
  - c) Fire retardant paint
16. Explain formulation, composition and properties of paints.
17. How do you manufacture of sucrose from beat root.
18. Explain the preparation of cane sugar from molasses.
19. Explain manufacture of paper.
20. Explain the following :
  - a) Kraft pulp
  - b) Rag pulp
  - c) colouring of pulp
  - d) Sizing

**NOTE : For paper setters choosing the two Short Questions and two Long Questions  
for Each unit.**

## Semester-wise Revised Syllabus under CBCS, 2020-21

Four-year B.Sc. (Hons)  
 Domain Subject: **CHEMISTRY**  
 IV Year B.Sc.(Hons)–  
 Semester–V

Course Code:

Max Marks: 100

**Course7-C: Industrial Chemistry-2**

(Skill Enhancement Course (Elective), Credits: 05)

## Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of industrial waste management.
2. Acquire a critical knowledge on the preparation and applications of organic polymers.
3. Demonstrate the analysis of water quality parameters.
4. Explain the sources of air pollution.

**II. Syllabus** :(*Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.*)

**Unit-1: Organic Polymers-1****10 hours**

Basic definitions, degree of polymerization, classification of polymers- Natural and Synthetic polymers, Organic and Inorganic polymers, Thermoplastic and Thermo setting polymers, Plastics, Elastomers, Fibers and Resins, Linear, Branched and Cross- Linked polymers.

**Unit-2: Organic Polymers-2****10 hours**

Addition polymers and Condensation polymers, mechanism of polymerization- Free radical, ionic and Zeigler-Natta polymerization. Industrial manufacturing and applications of following polymers, Polystyrene, Poly acrylonitrile, Poly methacrylate.

**Unit-3: Air Pollution****8 hours**

Sources of air pollution, acid rain, photochemical smog, Greenhouse effect, Formation and depletion of ozone, sources and effects of various gaseous pollutants: NO<sub>x</sub>, SO<sub>x</sub>, SPM, CO, hydrocarbons, controlling methods of air pollution.

**Unit-4: Analysis of water****10hours**

Determination of total hardness of water, Dissolved oxygen, BOD, COD, total dissolved solids, turbidity, alkalinity, determination of chloride using Mohr's method.

**Unit-5: Industrial Waste Management 12hours**

Waste water treatment - primary, secondary & tertiary treatment. (All treatment methods in detail). Characteristics of solid wastes, methods of solid waste

treatment and disposal, microbiology involved in solid waste disposal, methods of solid waste disposal- composting, sanitary landfilling- economic, aesthetic and environmental problems.

**References:**

1. E.Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK
2. J.A.Kent: *Riegel's Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
3. P.C.Jain, M.Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
4. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry*, Vikas Publications, New Delhi.
5. B.K.Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut
6. O. P. Vermani, A. K. Narula: *Industrial Chemistry*, Galgotia Publications Pvt. Ltd., New Delhi.
7. A.K.De, *Environmental Chemistry*: New Age International Pvt, Ltd, New Delhi.
8. C.k.Varshney: *Water Pollution and Management*, Wiley Eastern Limited, Chennai.
9. S.S. Dara and D.D. Mishra: *Textbook of Environmental Chemistry and Pollution Control*, Revised edition, S.C.Hand & Co Ltd.

**Course 7-C: Industrial Chemistry-2-PRACTICAL SYLLABUS****III. Lab work-Skills Outcomes:**

On successful completion of this practical course, student shall be able to:

1. Learn the procedures for the determination of BOD and COD.
2. Demonstrate skills in the determination of chloride in the given water sample.
3. Acquire skills in determining the hardness of water.

**IV. Practical (Laboratory) Syllabus:(30hrs)**

(Max.50 Marks)

1. Determination of Hardness of water by EDTA titration.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Determination of chloride using Mohr's method.
5. Determination of pH, turbidity and total solids in water sample.
6. Determination of  $\text{Ca}^{+2}$  and  $\text{Mg}^{+2}$  in soil sample by flame photometry.
7. Determination of Ph in soil samples using pH metry.

**V. Lab References:**

1. Textbook of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
2. Textbook on Experiments and Calculations in Engineering Chemistry, S.S.Dara, S.Chand.

**VI. Co-Curricular Activities**

**a) Mandatory:** (Student training by teacher in field related skills: inlab:15, infield: 05 hours):

1. **For Teacher:** Training of students by the teacher in laboratory and field for not less than 15 hours on the field related skills in determination of hardness of water, estimation of COD and BOD in water sample, determination chloride ion in water sample.
2. **For Student:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the measurement of water quality parameters. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student*

*details, index page, details of place visited, observations, findings, and acknowledgements.*

5. Unit tests (IE).

**b) Suggested Co-Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

**VII. Suggested Question Paper Pattern:**

**Model Paper**

**Chemistry Course 7-C Industrial Chemistry - 2**

**Time : 3 Hours**

**Max. Marks : 75**

**PART – A**

**Answer any FIVE of the following questions.**

**Each carries FIVE marks.**

**5 x 5 = 25 Marks**

1. Write down Thermoplastic and Thermosetting polymers.
2. Define polymer and explain Natural and synthetic polymers.
3. Write down free radical & ionic polymerization.
4. Explain industrial manufacturing and applications of polystyrene.
5. Write down Acidrain & Smog.
6. Explain Greenhouse effect.
7. Explain about BOD and COD.
8. Explain dissolved oxygen & turbidity.
9. Explain characteristics of solid wastes.
10. Write down aesthetic and environmental problems.

**PART – B**

**Answer any FIVE of the following questions.**

**Each carries TEN marks.**

**5 x 10 = 50 Marks**

11. Explain the following :
  - a) Elastomers
  - b) Fibers and Resins
  - c) Plastics
12. Define organic and Inorganic polymers and explain Linear, Branched and cross linked polymers.
13. Explain addition and condensation polymers.

14. Explain the following :
  - a) Zeigler – Natta polymerization
  - b) poly methacrylate
15. Explain controlling methods of air pollution.
16. Explain the following :
  - a) Depletion of ozone
  - b)  $\text{NO}_x$  ,  $\text{SO}_x$ , SPM, Co pollutants.
17. Explain determination of chloride using Mohr's method.
18. Explain the following :
  - a) Determination of total hardness of water.
  - b) Alkalinity
19. Explain primary, secondary, tertiary treatment of waste water.
20. Explain methods of solid waste.

**NOTE : For paper setters choosing the two Short Questions and two Long Questions**

**for Each unit.**

## Semester-wise Revised Syllabus under CBCS, 2020-21

Four-year B.Sc.  
(Hons) Domain Subject:  
**CHEMISTRY**

Course Code:

IV Year B.Sc.(Hons)–Semester –V (from 2022-23)

**Course6-D: Environmental Chemistry**  
(Skill Enhancement Course (Elective), Credits -05 Max Marks: 100+50)

**I. Learning Outcomes:**

Students after successful completion of the course will be able to:

1. Understand the environment functions and how it is affected by human activities.
2. Acquire chemical knowledge to ensure sustainable use of the world's resources and ecosystems services.
1. Engage in simple and advanced analytical tools used to measure the different types of pollution.
4. Explain the energy crisis and different aspects of sustainability.
5. Analyze key ethical challenges concerning biodiversity and understand the moral principles, goals and virtues important for guiding decisions that affect Earth's plant and animal life.

**II Syllabus** : ( Total Hours: 90, including Teaching, Lab, Field Skills Training, Unit tests etc.)

**UNIT-I Introduction 10h**

Environment Definition – Concept of Environmental chemistry- Scope and importance of environment in nowadays – Nomenclature of environmental chemistry – Segments of environment– Effects of human activities on environment – Natural resources–Renewable Resources–Solar and biomass energy and Nonrenewable resources – Thermal power and atomic energy.

**UNIT-II****Air Pollution 10h**

Definition – Sources of air pollution – Classification of air pollution – Ambient air quality standards- Climate change – Global warming – Pollution from combustion systems- Acid rain – Photochemical smog – Greenhouse effect – Formation and depletion of ozone – Bhopal gas disaster–Controlling methods of air pollution.

**UNIT-III****Water pollution 10h**

Unique physical and chemical properties of water – Water quality standards and parameters – Turbidity- pH Dissolved oxygen – BOD, COD, Hardness of water–Methods to convert temporary hard water in to soft water – Methods to convert permanent hard water into soft water – eutrophication and its effects –Industrial waste water treatment.

**UNIT-IV****Chemical Toxicology 10h**

Toxic chemicals in the environment – effects of toxic chemicals – cyanide and its toxic effects – pesticides and its biochemical effects – toxicity of lead, mercury, arsenic and cadmium- Solid waste management.

**UNIT-V****Ecosystem and biodiversity 10h****Ecosystem**

Concepts–structure–Functions and types of ecosystem–Abiotic and biotic components – Energy flow and Energy dynamics of ecosystem– Food chains – Food web– Tropic levels– Biogeochemical cycles (carbon, nitrogen and phosphorus)

**Biodiversity**

Definition – level and types of biodiversity – concept- significance – magnitude and distribution of biodiversity–trends-bio geographical classification of India–biodiversity at national, global and regional level.

**III. List of Reference books:**

1. Fundamentals of ecology by M.C.Dash
2. A Text book of Environmental chemistry by W. Moore and F.A. Moore
3. Environmental Chemistry by Samir k.Banerji
4. Water pollution, Lalude, MC Graw Hill
5. Environmental Chemistry, Anil Kumar De, Wiley Eastern Ltd.
6. Environmental analysis, SM Khopkar ( IIT Bombay )
7. Environmental Chemistry by BK Sharma & H Kaur, Goel publishing house.
8. Fundamentals of Environmental Chemistry, Manahan, Stanley. E
9. Applications of Environmental Chemistry, Eugene R. Wiener
10. Web related references suggested by teacher.

**Course6-D: Environmental Chemistry – Practical syllabus****IV. Lab work-Skills Outcomes:**

On successful completion of this practical course, student shall be able to:

1. List out, identify and handle various equipment in Chemistry lab.
2. Learn the procedures of preparation of standard solutions.
3. Demonstrate skills in operating instruments.
4. Acquire skills in handling spectrophotometer.
5. Analyse water and soil samples.

**V. Practical (Laboratory) Syllabus: (30hrs) (Max.50Marks).**

1. Identification of various equipment in the laboratory.
2. Determination of carbonate and bicarbonate in water samples by double titration method.
3. Determination of hardness of water using EDTA
  - a) Permanent hardness
  - b) Temporary hardness
4. Determination of Chlorides in water samples by Mohr's method.
5. Determination of pH, turbidity and total solids in water sample.
6. Determination of  $\text{Ca}^{+2}$  and  $\text{Mg}^{+2}$  in soil sample by flame photometry.
7. Determination of PH in soil samples using pH metry.



**VI. List of Reference books:**

1. A Text Book of Quantitative Inorganic Analysis (3<sup>rd</sup> Edition)–A.I.Vogel
2. Water pollution, Lalude, MC Graw Hill
3. Environmental analysis, SM Khopkar ( IIT Bombay )
4. Web related references suggested by teacher.

**VII. Co-Curricular Activities:**

a) **Mandatory:** (Training of students by teacher on field related skills: 15hrs)

**1. For Teacher:** Skills training of students by the teacher in classroom, lab and field for not less than 15 hours on field related quantitative techniques for the water quality parameters, soil pollution and air pollution.

**2. For Student:** Individual visit to any one of the local field agencies/research laboratories in universities/research organizations/private sector culminating writing and submission of a hand-written fieldwork/project work Report not exceeding 10 pages in the given format.

**3.** Max marks for Fieldwork/project work Report: 05.

**4.** Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of places visited, observations, findings and acknowledgements.*

**5.** Unit tests (IE).

**b) Suggested Co-Curricular Activities:**

1. Training of students by related industrial experts.
2. Visits to research organizations and laboratories.
3. Invited lectures and presentations on related topics by field / industrial experts.
4. Assignments.
5. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
6. Preparation of videos on tools, techniques and applications of spectrophotometry.

**VIII. Suggested Question Paper Pattern and Model (Theory):****Model Paper****Chemistry Course 6-D Environmental Chemistry****Time : 3 Hours****Max. Marks : 75**

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**PART – A****Answer any FIVE of the following questions.****Each carries FIVE marks.****5 x 5 = 25 Marks**

1. Write down Natural and Renewable Resources.
2. Explain Thermal power and atomic energy.
3. Write down Acid rain and photochemical smog.
4. Write down classification of air pollution.
5. Explain BOD and COD.
6. Write notes on physical and chemical properties of water.
7. Write note on Pesticides.
8. Explain solidwaste management.
9. Write down types of biodiversity.
10. Explain the following :
  - a) Abiotic and biotic components
  - b) Food chain

**PART – B****Answer any FIVE of the following questions.****Each carries TEN marks.****5 x 10 = 50 Marks**

11. Explain Definition, scope and importance of Environment.
12. Explain the following :
  - a) Solar and biomass energy
  - b) Effects of human activities on environment
13. Explain controlling methods of air pollution.
14. Explain the following :
  - a) Bhopal gas disaster
  - b) Global warming
15. Explain method to convert permanent hard water into soft water.
16. Explain Industrial waste water treatment and Eutrophication.

17. Explain toxicity of lead, mercury, Arsenic.
18. Explain toxic effects of cyanide and cadmium.
19. Explain Biogeochemical cycles.
20. Explain India – biodiversity at national, global and regional level.

**NOTE : For paper setters choosing the two Short Questions and two Long Questions**

**for Each unit.**

Semester-wise Revised Syllabus under CBCS, 2020-21

Course Code:

Four-year B.Sc. (Hons)  
Domain Subject: **CHEMISTRY**

IV Year B. Sc.(Hons) Semester –V (from 2022-23)

Course7- D: Green Chemistry and Nanotechnology  
(Skill Enhancement Course (Elective), Credits – 05)

Max Marks: 100+50

**1. Learning Outcomes:**

Students after successful completion of the course will be able to:

1. Understand the importance of Green chemistry and Green synthesis.
2. Engage in Microwave assisted organic synthesis.
3. Demonstrate skills using the alternative green solvents in synthesis.
4. Demonstrate and explain enzymatic catalysis.
5. Analyse alternative sources of energy and carry out green synthesis.
6. Carry out the chemical method of nanomaterial synthesis.

**VI. Syllabus:** *Total Hours: 90, including Teaching, Lab, Field Training, Unit tests etc.)***UNIT-I Green Chemistry: Part- I**

10 hrs

Introduction-Definition of green Chemistry, Need for green chemistry, Goals of Green chemistry Basic principles of green chemistry. Green synthesis- Evaluation of the type of the reaction

i) Rearrangements (100% atom economic), ii) Addition reaction (100% atom economic). Organic reactions by Sonication method: apparatus required and examples of sonochemical reactions (Heck, Hunsdiecker and Wittig reactions).

**UNIT- II Green Chemistry: Part- II**

10 hrs

**A) Selection of solvent:**

- i) Aqueous phase reactions
- ii) Reactions in ionic liquids, Suzuki reactions, epoxidation. iii) Solid supported synthesis

**B) Supercritical CO<sub>2</sub>:** Preparation, properties and applications, (decaffeination, drycleaning)**C) Green energy and sustainability.****UNIT-III Microwave and Ultrasound assisted green synthesis:**

10 hrs

Apparatus required, examples of MAOS (synthesis of fused anthraquinones, Leuckart reductive amination of ketones) - Advantages and disadvantages of MAOS. Aldolcondensation –Cannizzaro reaction- Diels-Alder reactions-Strecker's synthesis

**UNIT-IV Green catalysis and Green synthesis** 10 hrs.

Heterogeneous catalysis, use of zeolites, silica, alumina, supported catalysis - bio catalysis: Enzymes, Phase transfer catalysis (micellar /surfactant)

1. Green synthesis of the following compounds: adipic acid, catechol, disodium menudo acetate(alternative Strecker's synthesis)

- Microwave assisted reaction in water –Hoffmann elimination – methyl benzoate to benzoic acid – oxidation of toluene and alcohols–microwave assisted reactions in organic solvents. Diels-Alder reactions.
- Ultrasound assisted reactions–sonochemical Simmons–Smith reaction (ultrasonic alternative to iodine)

### UNIT – V Nanotechnology in Green chemistry

10 hrs

Basic concepts of Nano science and Nanotechnology – Bottom-up approach and Top down approaches with examples – Synthesis of Nano materials – Classification of Nanomaterial – Properties and Application of Nanomaterial. Chemical and Physical properties of Nanoparticles – Physical synthesis of nanoparticles – Inert gas condensation - Chemical Synthesis of nanoparticles – precipitation and co-precipitation method, sol-gel method.

### III. Lab work - Skills Outcomes:

On successful completion of this practical course, student shall be able to:

- List out, identify and handle various equipment in the laboratory.
- Learn the procedures of green synthesis.
- Demonstrate skills in the preparation of Nanomaterials.
- Acquire skills in Microwave assisted organic synthesis.
- Perform some applications of Nanomaterials.

### IV. Practical (Laboratory) Syllabus: (30 hrs.) (Max.50 Marks).

- Identification of various equipment in the laboratory.
- Acetylation of 1<sup>o</sup> amine by green method: Preparation of acetanilide
- Rearrangement reaction in green conditions: Benzil - Benzilic acid rearrangement
- Radical coupling reaction: Preparation of 1,1-bis -2-naphthol
- Green oxidation reaction: Synthesis of adipic acid
- Preparation and characterization of biodiesel from vegetable oil/ waste cooking oil
- Preparation and characterization of Nanoparticles of gold using tea leaves.
- Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.
- Photo reduction of Benzophenone to Benzopinacol in the presence of sunlight.

### V. Reference books:

- Green Chemistry Theory and Practical. P.T.Anatas and J.C. Warner
- Green Chemistry V.K. Ahluwalia Narosa, New Delhi.
- Real world cases in Green Chemistry M.C. Cann and M.E. Connelly
- Green Chemistry: Introductory Text M.Lancaster: Royal Society of Chemistry (London)
- Principles and practice of heterogeneous catalysis, Thomas J.M., Thomas M.J., John Wiley
- Green Chemistry: Environmental friendly alternatives R S Sanghli and M.M Srivastava, Narosa Publications
- Nanotechnology: Health and Environmental Risks, Jo Anne Shatkin, CRC Press (2008).
- Green Processes for Nanotechnology: From Inorganic to Bioinspired Nanomaterials, Vladimir A. Basiuk, Elena V. Basiuk Springer (2015)
- Web related references suggested by teacher.

**VI. Co-Curricular Activities:**

**a) Mandatory:** (*Training of students by teacher on field related skills: 15 hours*)

**1. For Teacher:** Training of students by the teacher in the classroom or in the laboratory for not less than 15 hours on field related quantitative techniques for Enzymatic catalysis, Microwave assisted organic synthesis, Biodiesel preparation etc.

**2. For Student:** Individual visit to any one of the local field agencies, research laboratories in universities/research organizations/private sector culminating writing and submission of a hand-written fieldwork/project work Report not exceeding 10 pages in the given format.

**3.** Max marks for fieldwork/project work Report: 05.

**4.** Suggested Format for fieldwork/project work: *Title page, student details, index page, details of places visited, observations, findings and acknowledgements.*

**5.** Unit tests (IE).

**b) Suggested Co-Curricular Activities:**

1. Training of students by related industrial experts.
2. Visits to research organizations and laboratories.
3. Invited lectures and presentations on related topics by field / industrial experts.
4. Assignments.
5. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
6. Preparation of videos on tools, techniques and applications of Green chemistry and Nanosynthesis.

**VII. Suggested Question Paper Pattern/ Model (Theory):****Model Paper****Chemistry Course 7-D Green chemistry and Nanotechnology****Time : 3 Hours****Max. Marks : 75**

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**PART – A****Answer any FIVE of the following questions.****Each carries FIVE marks.****5 x 5 = 25 Marks**

1. Explain Definition and Need of green chemistry.
2. Write notes on Green synthesis.
3. Write notes on Suzuki reaction.
4. Explain solid supported synthesis.
5. Describe the green synthetic procedure for the Diels – alder reaction.
6. Describe the green synthetic procedure for the strecker's synthesis.
7. Brief notes on Bio catalysis.
8. Discuss about ultrasound assisted reactions.
9. How do you synthesis nanoparticles from sol-gel method.
10. Write short notes on Nanotechnology.

**PART – B****Answer any FIVE of the following questions.****Each carries TEN marks.****5 x 10 = 50 Marks**

11. a) Explain the Basic principles of green chemistry.  
b) Discuss atom economy reactions.
12. Illustrate the sonication method with any two reactions.
13. Describe the preparation and properties of super critical carbondioxide.
14. Explain Green energy and sustainability.
15. Explain the synthesis of fused anthroquinines by microwave assisted organic synthesis.
16. Describe the green synthetic procedure for cannizzaro and Aldol condensation.
17. How are adipic acid and catechol prepared by Green synthesis.
18. Explain the following :
  - a) Heterogeneous catalysis

- b) Microwave assisted reaction for Hoffmann elimination.
19. Discuss the classification, properties and applications of Nanomaterials.
  20. How do you synthesis of nanoparticles from precipitation and co-precipitation method.

**NOTE : For paper setters choosing the two Short Questions and two Long Questions**

**for Each unit.**



## Semester-wise Revised Syllabus under CBCS, 2020-21

Four-year B.Sc. (Hons)

Course Code:

Domain Subject -

**CHEMISTRY**

IV Year B. Sc.(Hons)–Semester –V (from 2022-23)

Course6-E: Analytical Methods in Chemistry (Skill

Enhancement Course (Elective), Credits: 05)

Max Marks: 100+50

**I. Learning Outcomes:**

Students after successful completion of the course will be able to:

1. Understand the various methods involved in Quantitative analysis.
2. Acquire a critical knowledge on separation techniques.
3. Demonstrate skills related to Chromatographic techniques through hands on experience.
4. Able to engage in safe and accurate laboratory practices by handling laboratory glassware, Equipment and chemical reagents appropriately.
5. Comprehend the applications of Chromatographic techniques in different fields.

**II. Syllabus:** *Total Hours: 90, including Teaching, Lab, Field Skills Training, Unit tests etc.)***Unit-1: Quantitative analysis**

(10hrs)

Importance in various fields of science, steps involved in chemical analysis. Principles of volumetric analysis: Theories of acid-base, redox, complex metric, iodometric and precipitation titrations Detection of end point in redox titration, choice of indicators for the saturations. Principles of gravimetric analysis: precipitation, peptization, co-precipitation, post-precipitation, digestion, filtration and washing of precipitate, drying and ignition.

**Unit-2: Treatment of analytical data:**

(10hrs)

Types of errors, significant figures and its importance, accuracy-methods of expressing accuracy, absolute and relative errors, error analysis and minimization of errors.

Precision - methods of expressing precision, standard deviation and confidence limit.

**Unit-3: Separation techniques in Chemical analysis:**

(10hrs)

Solvent Extraction: Introduction, principle, techniques, factors affecting solvent extraction, Batch extraction, continuous extraction and counter current extraction. Application - Determination of Iron (III).

Ion Exchange: Introduction, action of ion exchange resins, separation of inorganic mixtures, applications.

**Unit- 4: Chromatography: Part - I (10hrs)**

Classification of chromatography methods, principles of differential migration adsorption phenomenon, Nature of adsorbents, solvent systems,  $R_f$  values, factors effecting  $R_f$  values. Paper Chromatography: Principles,  $R_f$  values, experimental procedures, choice of paper and solvent systems, developments of chromatogram-ascending, descending and radial. Two dimensional chromatography, applications.

**Unit– 5: Chromatography: Part - II (10hrs)**

Thin layer Chromatography (TLC): Advantages. Principles, factors effecting  $R_f$  values. Experimental procedures. Adsorbents and solvents. Preparation of plates. Development of the chromatogram. Detection of the spots. Applications.

Column Chromatography: Principles, experimental procedures, Stationary and mobile Phases, Separation techniques, Applications. HPLC: Basic principles and applications.

**III. Lab work-Skills Outcomes:**

On successful completion of this practical course, student shall be able to:

1. List out, identify and handle various equipment in Analytical Chemistry lab.
2. Learn the procedures of preparation of primary and secondary standard solutions.
3. Demonstrate skills in the preparation of Paper, Thin layer and column Chromatography.
4. Acquire skills in observing the Chromatogram.
5. Perform some separation techniques of Organic compounds.

**IV. Practical (Laboratory) Syllabus :( 30hrs) (Max.50Marks).**

1. Identification and handling of various laboratory equipment.
2. Determination of Zn(II)/ Mg(II) using EDTA
3. Determination of Fe (II) present in an Iron tablet using  $\text{KMnO}_4$ . Redox titration.
4. Determination of Saponification value of oil and Iodine value of oil.
5. Paper chromatographic separation of  $\text{Fe}^{3+}$ ,  $\text{Al}^{3+}$ , and  $\text{Cr}^{3+}$ .
6. Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the  $R_f$  values.
7. Chromatographic separation of the active ingredients of plants, flowers and juices by TLC.
8. Separation by Column Chromatography – Mixture of Ortho and Para Nitro anilines.

**V. List of Reference Books**

1. Analytical Chemistry by Skoog and Miller
2. A text book of qualitative in organic analysis by A.I.Vogel
3. Nano chemistry by Geoffrey Ozin and Andre Arsenault
4. Stereo chemistry by D.Nasipuri
5. Organic Chemistry by Clayden
6. Analytical Chemistry by Gary D. Christian, 6<sup>th</sup> edition
7. Chemistry experiments for instrumental methods, Donald T Sawyer William
8. Instrumental methods of analysis, Willard, Merit, Dean, 6<sup>th</sup> edition.
9. Web related references suggested by teacher.

**VI. Co-Curricular Activities:**

**a) Mandatory:** (training of students by teacher on field related skills: 15 hrs.)

**1. For Teacher:** Training of students by the teacher in laboratory and field for not less than 15 hours on field related Quantitative techniques like Separation techniques, preparation by Column, preparation of TLC and determination of the purity of the sample.

**2. For Student:** Individual visit to any one of the Field agency, research laboratories in universities/research organizations/private sector culminating writing and submission of a hand-written fieldwork/project work Report not exceeding 10 pages in the given format.

**3.** Max marks for Fieldwork/project work Report: 05.

**4.** Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of places visited, observations, findings and acknowledgements.*

**5.** Unit tests (IE).

**b) Suggested Co-Curricular Activities:**

1. Training of students by related industrial experts.
2. Visitor research organizations and laboratories.
3. Invited lectures and presentations on related topics by field / industrial experts.
4. Assignments.
5. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
6. Preparation of videos on tools, techniques and applications of chromatography.

**VII. Suggested Question Paper Pattern and model :****Model Paper****Chemistry Course 6-E Analytical Methods in Chemistry****Time : 3 Hours****Max. Marks : 75****PART – A****Answer any FIVE of the following questions.****Each carries FIVE marks.****5 x 5 = 25 Marks**

1. Write notes on complex metric titrations with examples.
2. Answer the following :
  - a) Precipitation                      b) Peptization                      c) Filtration
3. Write a short notes on standard deviation.
4. Write notes on significant figures.
5. Write down principle involved in solvent extraction.
6. Write short notes on Batch extraction.
7. Define  $R_f$  value and explain factors effecting  $R_f$  values.
8. Brief notes on classification of chromatography.
9. Write types of adsorbents and solvents used in thin layer chromatography.
10. Outline the applications of High performance liquid chromatography.

**PART – B****Answer any FIVE of the following questions.****Each carries TEN marks.****5 x 10 = 50 Marks**

11. Describe the Acid – base titrations in detailed.
12. Explain the following :
  - a) Co-precipitation and post – precipitation      b) Redox titrations
13. Discuss various types of errors with suitable examples.

14. Explain the methods of expressing precision.
15. Explain continuous and counter current extraction.
16. Explain separation of inorganic mixtures by ion exchange method and also explain applications.
17. Write notes on principle and experimental procedure of paper chromatography.
18. Explain two dimensional chromatography and its applications.
19. Discuss the column chromatography. Write notes on applications.
20. Write the principle involved and applications of thinlayer chromatography. Discuss the preparation of thinlayer chromatography plates.

**NOTE : For paper setters choosing the two Short Questions and two Long Questions**

**for Each unit.**

## Semester-wise Revised Syllabus under CBCS, 2020-21

Course Code:

Four-year B.Sc. (Hons)

Domain Subject:

Chemistry

MaxMarks: 100+50

IV Year B. Sc.(Hons)– Semester – V (from 2022-23)

**I. Learning Outcomes:**

Course7- E: Cosmetics and Pharmaceutical  
Chemistry(Skill Enhancement Course (Elective),  
Credits- 05)

Students after successful completion of the course will be able to:

1. Explain the principles of formulation and application of Cosmetics & perfumes.
2. Acquire a critical knowledge on synthetic techniques of drugs.
3. Demonstrate the skills in various aspects of the fermentation technology and apply for production.
4. Comprehend the applications offer mentation.

**II. Syllabus:** *Total Hours: 90, including Teaching, Lab, Field Skills Training, Unit tests etc.)*

**Unit- I Chemistry of Cosmetics**

(8hrs)

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours.

**Unit- II Chemistry of Perfumes**

(8hrs)

Essential oils and their importance in cosmetic industries with reference to Eugenol, Geranial, sandalwood oil, eucalyptus, rose oil, 2-phenyl ethyl alcohol, Jasmine, Civet one, Mascon.

**Unit–III Drugs & Pharmaceuticals – I**

(10hrs)

Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, ibuprofen)

**Unit–IV Drugs & Pharmaceuticals - II**

(12hrs)

Synthesis of the representative drugs of the following classes: Antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glycerol tritrate), antilaprosy (Daps one), HIV-AIDS related drugs (AZT-Zidovudine).

**Unit – V Fermentation (12hrs)**

Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

**III. Lab work-Skills Outcomes:**

On successful completion of this practical course, student shall be able to:

1. The ability to develop comprehensive product development programs to meet new product criteria and timing.
2. Acquire skills in the preparation of Cosmeceuticals.
3. Demonstrate proficiency in the experimental techniques for fermentation and microbial

production of enzymes.

4. Carry out perfume testing with the knowledge of perfumes.
5. Learn the procedure of synthesis of drugs.
6. Critically develop, apply, report, interpret and reflect on strategies for collecting data in the lab and field.

**IV. Practical (Laboratory) Syllabus : ( 30hrs) (Max.50Marks)**

1. Identification of various equipment in the laboratory
2. Preparation of talcum powder.
3. Preparation of shampoo.
4. Preparation of hair remover.
5. Preparation of face cream.
6. Preparation of nail polish and nail polish remover.
7. Preparation of Aspirin and its analysis.
8. Preparation of Magnesium bisilicate (Antacid).
9. Fermentation process.

**V. Reference Books:**

1. A handbook of Industrial Organic Chemistry by Samuel P Sadtler, JB Lippincott company.
2. Handbook Industrial Chemistry by Mohammad Farhat Ali Khan, First edition
3. Related online methods available.
4. Industrial Chemistry, E. Stocchi: Vol -I, Ellis Horwood Ltd. UK.
5. Engineering Chemistry P.C. Jain, M. Jain:,Dhanpat Rai & Sons, Delhi.
6. Industrial Chemistry, Sharma, B.K. & Gaur, , Goel Publishing House, Meerut(1996)
7. Introduction to Medicinal Chemistry, G.L. Patrick: Oxford University Press, UK.
8. Medicinal and Pharmaceutical Chemistry, Hakishan, V.K. Kapoor:, VallabhPrakashan, Pitampura, New Delhi.
9. Principles of Medicinal Chemistry, William O. Foye, Thomas L., Lemke, David A. William: B.I. Waverly Pvt. Ltd. New Delhi.
10. Industrial Microbiology, 3rd Edition, JR Casida L.E. (2015New Age International (P) Limited Publishers, New Delhi, India.
11. Industrial Microbiology: An Introduction. 1st Edition, Waites M.J., Morgan N.L., Rockey J.S. and Highton G. (2001) Blackwell Science, London, UK.
12. Microbiology. 5th Edition, Pelczar M.J., Chan E.C.S. and Krieg N.R. (2003) Tata McGraw-Hill Publishing Company Limited, New Delhi.

**VI. Co-Curricular Activities:**

**a) Mandatory :** (*Training of students by teacher on field related skills: 15hrs*)

1. **For Teacher:** Training of students by the teacher in laboratory and field for not less than 15 hours on field skills/techniques like purification of the crude, Separation techniques, synthesis of simple drugs etc.
2. **For Student:** Individual visit to any one of the related local agencies, cosmetic industry, pharmaceutical laboratories in universities / research organizations / private sector culminating writing and submission of a hand-written fieldwork/project work Report not exceeding 10 pages in the given format.
3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of places visited, observations, findings and acknowledgements.*
5. Unit tests (IE).

**b) Suggested Co-Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments (including technical assignments like identifying tools in plant biotechnology and their handling, operational techniques with safety and security, IPR)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques in plant biotechnology.
5. Collection of material/figures/photos related to products of plant tissue culture, writing and organizing them in a systematic way in a file.

6. Visits to plant tissue culture/biotechnology facilities, firms, research organizations etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

**Suggested Question Paper Pattern and Model:**

**Model Paper**

**Chemistry Course 7-E Cosmetics and Pharmaceutical Chemistry**

**Time : 3 Hours**

**Max. Marks : 75**

**PART – A**

**Answer any FIVE of the following questions.**

**Each carries FIVE marks.**

**5 x 5 = 25 Marks**

1. Give a detailed outline of the method of preparation of lipsticks.
2. Differentiate between vanishing and cold creams. Discuss their preparation.
3. Explain the importance of essential oil in cosmetic industries.
4. Explain the importance of Eucalyptus oil in cosmetic industry.
5. Outline the synthesis of Aspirin.
6. Write notes on anti-inflammatory agents.
7. Give the synthesis of Diazepam.
8. Write notes on penicillin.
9. Write notes on vitamin B<sub>12</sub> and vitamin C.
10. Write about Ethyl alcohol and citric acid.

**PART – B**

**Answer any FIVE of the following questions.**

**Each carries TEN marks.**

**5 x 10 = 50 Marks**

11. What do you mean by cosmetics ? Explain preparation of shampoo and Hair dye ?
12. Explain the following :
  - a) Antiperspirants
  - b) Nail enamel
  - c) face powder
13. Explain the importance of roseoil and Geranial in cosmetic industry.
14. Explain the following :
  - a) Civet one
  - b) Mascon
  - c) Eugenol
15. What is Retro synthetic approach ? Explain the synthesis of paracetamol.
16. Define Drug ? Explain the synthesis of Ibuprofen.
17. Explain the synthesis of chloramphenicol and sulphacetamide.
18. Explain the following :



- a) Glycerol triturate                      b) AZT - Zidovudine
19. a) Explain fermentation and Aerobic fermentation.  
b) Explain the discovery of streptomycin.
20. Discuss how fermentation can be used for the industrial production of Lysine & Glutamic acid.

**NOTE : For paper setters choosing the two Short Questions and two Long Questions  
for Each unit.**

## Recommended Question Paper Patterns and Models

### BLUE PRINT FOR QUESTION PAPER PATTERN

Unit	S.A.Q (Including choice)	E.Q (Including choice)	Total Marks
I	2	2	30
II	2	2	30
III	2	2	30
IV	2	2	30
V	2	2	30
<b>Total</b>	<b>10</b>	<b>10</b>	<b>150</b>

S.A.Q = Short answer questions (5 Marks)

E.Q = Essay questions (10 Marks)

Short answer questions :  $5 \times 5 = 25$  Marks

Essay questions :  $5 \times 10 = 50$  Marks

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Total Marks = 75 Marks

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**Note :- For Paper Setters Choosing Two Short Questions and Two Long Questions for each Unit.**

REVISED UG SYLLABUS UNDER CBCS  
(Implemented from Academic Year, 2020-21)  
PROGRAMME: FOUR YEAR B.Sc.(Hons)  
Domain Subject: **CHEMISTRY**

**Skill Enhancement Courses (SECs) for Semester V, from 2022-23** (Syllabus with Learning Outcomes, References, Co-curricular Activities & Model Q.P. Pattern)

**Structure of SECs for Semester-V**

(To choose One pair from the Five alternate pairs of SECs)

Univ. Code	Course NO. 6&7	Name of Course	Th.Hrs / Week	IE Marks	EE Marks	Credits	Prac. Hrs./ Wk	Marks	Credits
	6A	Synthetic Organic Chemistry	3	25	75	3	3	50	2
	7A	Analysis of Organic Compounds	3	25	75	3	3	50	2
OR									
	6B	Analytical Methods in Chemistry-1	3	25	75	3	3	50	2
	7B	Analytical Methods in Chemistry-1	3	25	75	3	3	50	2
OR									
	6C	Industrial Chemistry-1	3	25	75	3	3	50	2
	7C	Industrial Chemistry-2	3	25	75	3	3	50	2
OR									
	6D	Environmental Chemistry	3	25	75	3	3	50	2
	7D	Green Chemistry and Nanotechnology	3	25	75	3	3	50	2
OR									
	6E	Analytical Methods in Chemistry	3	25	75	3	3	50	2
	7E	Cosmetics and Pharmaceutical Chemistry	3	25	75	3	3	50	2

**Note-1:** For Semester-V, for the domain subject Chemistry, any one of the five pairs of SECs shall be chosen as courses 6 and 7, i.e., 6A&7A or 6B&7B or 6C&7C or 6D&7D or 6E&7E. The pair shall not be broken (ABC allotment is random, not on any priority basis).

**Note-2:** One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented. Hence, teachers shall also impart practical training to students on the skills embedded in syllabus citing related real field situations.

