

# Programme Project Report (PPR)

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## Bachelor of Science in Chemistry (Semester - CBCS Pattern)



Department of Chemistry  
School of Science

**TAMIL NADU OPENUNIVERSITY**

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Chennai - 600 015

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**School of Science**

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TAMIL NADU OPEN UNIVERSITY

DEPARTMENT OF CHEMISTRY

SCHOOL OF SCIENCE

B.Sc. Chemistry

## Programme Project Report (PPR)

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### Programme's Mission:

Bachelor of Science in Chemistry Programme has been designed to provide in basic knowledge in Chemistry to those students who are not having opportunity to study in regular mode and for drop-out students from rural and urban areas of Tamil Nadu.

### Programme Objectives (PO):

While studying the Post Graduate Degree in Chemistry, a student shall able to

**PO1.** Impart knowledge in fundamental aspects of all branches of chemistry

**PO2.** Provide students the scientific skills and chemical knowledge essential for success.

**PO3.** Train the students in various quantitative and qualitative analyses

**PO4.** Enable the students to study of matter and the changes those material substances undergo.

**PO5.** Train students in proper laboratory and safety techniques.

**PO6.** Equip students with effective scientific communication skills.

**PO7.** Foster a commitment to ethical and social responsibilities.

### Programme Specific Objectives (PSO):

While studying the Under Graduate Degree in Chemistry, a student shall able to:

**PSO1.** Explain nomenclature, stereochemistry, structures, reactivity, and mechanism of the chemical reactions.

**PSO2.** Gain the theoretical as well as practical knowledge of handling chemicals and apparatus

**PSO3.** Find out the green route for chemical reaction for sustainable development.

**PSO4.** Develop the ability to apply the principles of Chemistry.

**PSO5.** Effectively communicate the results of their work to both chemists and non-chemists

in oral or written form

**PSO6.** Expand the knowledge available opportunities related to chemistry in the government services through public service commission particularly in the field of food safety, health inspector, pharmacist, etc.

**PSO7.** Achieve the skills required to succeed in graduate school, professional school and the chemical industry like cement industries, agro product, paint industries, rubber industries, petrochemical industries, food processing industries, fertilizer industries, etc.

**Relevance of the Programme with HEI's Mission and Goals:** The Programme B.Sc., (Chemistry) is offered to meet current needs of aspiring youths and adult population and also create awareness about the basic scientific aspects to the society. This Programme aims at creating equity in education by providing opportunity to rural people for whom the Higher Education is unreachable.

**Nature of prospective target group of Learners:** Bachelor of Science (Chemistry) is meant for students who have passed the Higher Secondary Examination with Chemistry as one of the Subjects or Secondary grade teachers are the target groups. It also targets the rural population to reach their dream of obtaining Higher Education for whom the opportunity was denied due to lack of limited number of seats available in the conventional University systems.

**Appropriateness of Programme to be conducted in ODL mode to acquire specific skills and competence:** Bachelor Degree Programme in Chemistry will meet out the present day needs of Academic and Research Institutions and Industries. As Programme outcome of the students may acquire basic knowledge in the Organic, Inorganic and Physical Chemistry which will motivate the students to go for higher studies/research in Chemistry and also acquire skills in the field of application oriented, life oriented, and job oriented Chemistry. Their learning needs will be addressed by

providing the printed copy of 'Self Learning Materials (SLM)' and Practical classes and Examination are being conducted at Learner Support Centres (LSCs).

**Instructional Design:** The Curriculum and the Syllabus for Bachelor of Science in Chemistry Programme has been designed to provide in basic knowledge in Chemistry to those students who are not having opportunity to study in regular mode and for drop-out students from rural and urban areas of Tamil Nadu. The main Objective of this Programme is to enable the students to understand the basic knowledge on the Chemicals, its reactions and make them relevant to the society. The course for the degree of Bachelor of Science in Chemistry shall consist of THREE years (SIX SEMESTERS) and the medium of instruction is ENGLISH.

The Bachelor of Science in Chemistry Programme is offered through the Learner Support Centres which are established by Tamil Nadu Open University at affiliated Arts and Science Colleges where the same Programme is offered through Conventional Mode.

The Faculty members available at Department of Chemistry, School of Science of Tamil Nadu Open University and the faculties approved as Academic Counselors by TNOU at Learner Support Centres will be used for delivering the Bachelor of Science Degree Programme in Chemistry.

The credits systems suggested as per UGC-ODL Regulations-2020 have been assigned to the Bachelor of Science in Chemistry Programme. The total number of credit assigned for the Programme is 106. The Self Learning Materials (SLM) in the form of print, e-content and audio/video materials wherever required has also been developed for the Programme.

#### **Procedure for Admissions, Curriculum Transaction and Evaluation:**

**Eligibility:** Candidates should have passed the Higher Secondary Examination (10+2 pattern) conducted by the Board of Higher Secondary Education, Government of Tamilnadu or any other examination (10+3 pattern) accepted by Syndicate, as equivalent thereto, with Chemistry as one of the subjects in the above said patterns.

The Programme Fee is Rs.18000/- for three years, plus Registration and other Charges.<sup>7</sup>  
The admission are carried out by Tamil Nadu Open University and through its Regional Centres located within the State of Tamil Nadu. The Theory Counselling and the Practical Counselling classes will be conducted through the Learners Support

Centres of Tamil Nadu Open University. The evaluation will be carried by Tamil Nadu Open University as based on the Continuous Internal Assessment through Assignment and External Assessment through Term End Examinations.

**Medium: English**

**Duration of the Course:** The minimum duration for pursuing the degree of Bachelor of Science in Chemistry is THREE years. The maximum duration shall be adhere as per TNOU regulations time to time.

**Financial Assistance:** SC/ST Scholarship available as per the norms of the State Government of Tamil Nadu. Complete Admission fee waiver for the physically challenged/differently abled persons.

**Policy of Programme delivery:** The Academic Calendar for the Programme will be available for the learners to track down the chronological events/happenings. The Counselling schedule will be uploaded in the TNOU website and the same will be intimated to the students through SMS.

**Evaluation System:** Examination to Bachelor's Degree Programme in Chemistry is designed to maintain quality of standard. Theory will be conducted by the University in the identified Examination Centres. For the Assignment students, may be permitted to write with the help of books/materials for each Course, which will be evaluated by the Evaluators who are appointed by the University.

**Continuous Internal Assessment (CIA): Assignment:** 1 assignment for 2 credits are to be prepared by the learners. E.g. If a Course is of Credit 6, then 3 number of Assignments are to be written by the learner to complete the continuous assessment of the course. Assignment carries 30 Marks (Average of Total no of Assignment), consists of Long Answer Questions (1000 words) for each Course.

Sec- A	Answer any one of the question not exceeding 1000 words out of three questions.	1 x 30 = 30 Marks
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**Theory Examination:** Students shall normally be allowed to appear for theory examination by completing Practical and Assignment. The Term -End Examination shall Carry 70 marks and has PART: A, B and C and will be of duration 3 hours.



## Question Pattern for Theory Examinations

Course Name:

Course Code:

Time: 3 Hours

Maximum Marks: 70

### **PART - A (3 × 3 = 9 marks)**

Answer any Three questions out of Five questions in 100 words

All questions carry equal marks

1. From Unit - I
2. From Unit - II
3. From Unit - III
4. From Unit - IV
5. From Unit - V

### **PART - B (3 × 7 = 21 marks)**

Answer any Three questions out of Five questions in 200 words

All questions carry equal marks

6. From Unit - I
7. From Unit - II
8. From Unit - III
9. From Unit - IV
10. From Unit - V

### **PART - C (4 × 10 = 40 marks)**

Answer any Four questions out of Seven questions in 500 words.

All questions carry equal marks.

11. From Unit - I
12. From Unit - II
13. From Unit - III
14. From Unit - IV
15. From Unit - V
16. From any unit
17. From any unit

### **Question Paper Pattern for Practical Examinations:**

- Practical - I (Volumetric Analysis): Any ONE estimation.
- Practical - II (Inorganic Semi-micro Qualitative Analysis): Analysis of any ONE anion and ONE cation.

- Practical - III (Organic Analysis and Estimation): Any ONE analysis or any ONE estimation.
- Practical - IV: (Gravimetric Analysis and Physical Chemistry): Any ONE experiment.

**Awarding of marks for Practical examinations:**

Total Marks: 100 (External Practical 70 Marks + Internal (20 marks for Record note submission + 10 marks for the attendance of Practical Counselling Classes)

Marks distribution for the external practical examinations to 70 Marks is based on the Results, Record, Procedure writing and Vivo-voce)

**Passing Minimum:**

For Theory Examination: The candidate shall be declared to have passed the theory examination if the candidate secures not less than 25 marks in the Term End Examinations (TEE) in each theory paper and secures not less than 13 marks in the Continuous Internal Assessment (CIA) [The mark distributions in CIA will be adhere as per TNOU norms time to time] and overall aggregated marks is 40 marks in both external and internal taken together. The Candidate must secure the minimum aggregated total of 40 marks for passing in the each course.

Continuous Internal Assessment (CIA)		Term End Examination (TEE)		Overall Aggregated Marks	Maximum Marks
Minimum Mark	Maximum Mark	Minimum Mark	Maximum Mark	CIA + TEE	
13	30	25	70	40	100

For Practical Examination: The candidate shall be declared to have passed the practical examination if the candidate secures not less than 25 marks in the external practical examinations in each practical course and secures not less than 13 marks in the Continuous Internal Assessment (CIA) (Record Marks + Practical Counselling Class Attendance) and overall aggregated marks is 40 marks in both external and internal taken together. The Candidate must secure the minimum aggregated total of 40 marks for passing in the each course.

Continuous Internal Assessment (CIA)	External Practical Examination (EPE)	Overall Aggregated Marks	Maximum Marks

Minimum Mark	Maximum Mark	Minimum Mark	Maximum Mark	CIA + EPE	
13	30	25	70	40	100

### Classification of Successful Candidate:

Candidates who pass all the courses prescribed and who secure

- 75% and above (in first attempt only) will be placed in the *First class with Distinction*.
- 60% and above in the aggregate of marks will be placed in the *First Class*.
- 50% and above but below 60% in the aggregate will be placed in the *Second Class*.
- All other successful candidates will be placed in the *Third Class*.

### Requirement of Laboratory and Library Resources:

The B.Sc. Chemistry Programme will be offered through the Learner Support Centres (LSCs) which are monitored/maintained by Tamil Nadu Open University. The LSC's are having the required infrastructural facilities to conduct the practical counselling classes of all the experiments which are given in the syllabi and also have the required facilities to conduct the external practical examinations.

A well-equipped Library is available in the University Headquarters with about 24,000 books and having many reputed research journals for reference. Further, the LSC's through which the Degree Programme is being offered, are also equipped with full-fledged library facilities related to the Chemistry courses.

**Quality Assurance Mechanism & Programme Objectives/Outcomes:** The Quality of the Bachelor Degree Programme in Chemistry is maintained by adopting the curriculum suggested by the UGC. The required core courses, elective courses and practical courses are included in the Programme as per the UGC guidelines. The Curriculum of B.Sc. Chemistry in semester pattern was approved by the Board of Studies of Department of Chemistry, which was conducted on 18.06.2020. Subsequently, the Curriculum was approved by the Academic Council and Syndicate of our University. As a part of Quality assurance, the Curriculum of B.Sc. Chemistry will be updated once in three years. Also, the steps are being taken to obtain the feedback from the students and from the Academic Counsellors who are involved in delivering the programme in an effective manner.

## Structure of the B.Sc. Chemistry Programme

Course	Course Code	Course Title	Category	Evaluation		Credit
				CIA+TEE	Total	
<b>I Year - Semester I</b>						
Language	BFTMS-11	Tamil/other language	Language	30+70	100	3
Language	BFEGS-11	Foundation in English	Language	30+70	100	3
Core I	BCHES-11	Chemistry-I	CC	30+70	100	4
Ancillary-I	BZOOSA-11	Animal Diversity	GE	30+70	100	3
Elective-I	BCAS-13	Office Automation	AEC	30+70	100	2
<b>I Year - Semester II</b>						
Language	BFTMS-21	Tamil/other language	Language	30+70	100	3
Language	BFEGS-21	Foundation in English	Language	30+70	100	3
Core II	BCHES-21	Chemistry-II	CC	30+70	100	4
Ancillary-II	BZOOSA-22	Economic Zoology	GE	30+70	100	3
Core Practical-I	BCHES-P1	Volumetric Analysis	SEC	30+70	100	4
<b>II Year - Semester III</b>						
Language	BFTMS-31	Tamil/other language	Language	30+70	100	3
Language	BFEGS-31	Foundation in English	Language	30+70	100	3
Core III	BCHES-31	Chemistry-III	CC	30+70	100	4
Ancillary-III	BPHYSA-11	Allied Physics-I	GE	30+70	100	3
Elective-II	--	Learner 's Choice from other major – CBCS	GE	30+70	100	2
<b>II Year - Semester IV</b>						
Language	BFTMS-41	Tamil/other language	Language	30+70	100	3
Language	BFEGS-41	Foundation in English	Language	30+70	100	3
Core IV	BCHES-31	Chemistry-IV	CC	30+70	100	4
Ancillary-IV	BPHYSA-22	Allied Physics-II	GE	30+70	100	3
Core Practical-II	BCHES-P2	Inorganic Semi-micro Qualitative Analysis	SEC	30+70	100	4
Elective	CCE	Environmental Science	AEC	30+70	100	2
<b>III Year - Semester V</b>						
Core V	BCHES-51	Inorganic Chemistry-I	DSE	30+70	100	4
Core VI	BCHES-52	Organic Chemistry-I	DSE	30+70	100	4
						<b>12</b>

Core VII	BCHES-53	Physical Chemistry-I	DSE	30+70	100	4
Core VIII	BCHES-54	Polymer Chemistry	DSE	30+70	100	4
Core Practical-III	BCHES-P3	Organic Analysis and Estimation	SEC	30+70	100	4
<b>III Year - Semester VI</b>						
Core IX	BCHES-61	Inorganic Chemistry-II	DSE	30+70	100	4
Core X	BCHES-62	Organic Chemistry-II	DSE	30+70	100	4
Core XI	BCHES-63	Physical Chemistry-II	DSE	30+70	100	4
Core XII	BCHES-64	Environmental Chemistry and	DSE	30+70	100	4
Core Practical-IV	BCHES-P4	Gravimetric Analysis & Physical Chemistry Experiments	SEC	30+70	100	4
Total					3100	106

- *Continuous Internal Assessment - CIA*
- *Term End Examination - TEE*
- *Core Course - CC*
- *Ability Enhancement Course - AEC*
- *Skill Enhancement Course - SEC*
- *Discipline Specific Elective - DSE*
- *Generic Elective - GE*

### **Programme Outcomes (POC):**

After successful completion of Under Graduate Degree in Chemistry, a student will be able to:

**POC1.** Demonstrate, solve and an understanding of major concepts in all disciplines of chemistry.

**POC2.** Think critically, systematically, independently to analyze the chemical problems and to draw a logical conclusion.

**POC3.** Familiarize with the emerging areas of Chemistry and their applications in various spheres of Chemical sciences and to apprise the students of its relevance in future studies.

**POC4.** Create an awareness of the impact of chemistry on the environment, society, and development outside the scientific community.

**POC5.** Design, carry out, record and analyze the results of chemical experiments and are familiar with standard safety practices, equipment, procedures, and techniques common to most working laboratories.

**Programme Learning Outcomes:**

**PLO 1: Science Knowledge:** Apply pure and interdisciplinary science knowledge for the solution of various scientific and engineering problems.

**PLO 2: Problem analysis:** Identify, formulate, review research literature, and analyze scientific problems reaching validated conclusions using basic principles of sciences.

**PLO 3: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis, and interpretation of data, and synthesis of the information to provide valid conclusions.

**PLO 4: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern IT tools including prediction and modeling to complex scientific activities with an understanding of the limitations.

**PLO 5: The science and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional practice.

**PLO 6: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the scientific practice.

**PLO 7: Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PLO 8: Communication:** Communicate effectively on various activities with the Science community and with society at large, such as being able to comprehend and write effective reports and design documentation, make

effective presentations and give and receive clear instructions.

PLO 8: **Science projects and funding:** Demonstrate knowledge for writing and managing scientific projects in various disciplines and apply these to its own work, as a member and leader in a team, manage funds for scientific projects from various funding agencies and NGOs.

PLO 9: **Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.













Tamil Nadu Open University  
Department of Chemistry  
School of Science  
Chennai - 15

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**B.Sc. CHEMISTRY SYLLABUS - I YEAR - I SEMESTER (Distance Mode)**

**COURSE TITLE** : Foundation in English-I (Literature and Grammar)  
**COURSE CODE** : BFEGS - 11  
**COURSE CREDIT** : 3

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**COURSE OBJECTIVES (CO)**

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While studying this course, the student will be able to:

- CO1. To make the learners aware of the history of England
  - CO2. To cultivate the creativity among the learners
  - CO3. To improve the reading skills of the learners
  - CO4. To enhance the vocabulary of the learners
  - CO5. To make the learners read and write in English
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**COURSE OUTCOMES (COC)**

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On successful completion of the Course, the learners will be able to:

- COC1. Describe the history of England
- COC2. Critically analyse the literary texts
- COC3. Use the words correctly

COC4. Write in flawless English

**Block-1      Brief History of England**

Tudor England- Stuart England -Restoration England -Revolutions -Eighteenth Century-19<sup>th</sup> Century Education- 20<sup>th</sup> Century

**Block 2      Literary Texts**

R.K. Narayan- *An Astrologer's Day* and Sarojini Naidu - *Bangle Sellers*

**Block-3      Reading Comprehension**

Definition of Comprehension- Types of Comprehension- Reading Materials- Vocabulary- Critical Reading- Effective Reading- Exercises

**Block -4      Functional Grammars and Vocabulary**

Parts of Speech- Tenses-Articles -Prepositions and Linkers -Punctuation-Common Mistakes -Polite Expression-Affixes

**Block-5      Language Skills**

Reading Skills: SQ3R Technique -Writing Skills -Dictionary Use

**References:**

1. Narayan R.K. *Short Story Collections*.
2. Sarojini Naidu. *Bangle Sellers*
3. Sinha C.A. *Reading Comprehension*. Prabhat Prakashan.
4. Xavier A.G. *An Introduction to the Social History of England*. Viswanathan S. Printers, Chennai. 2009.

**Web Resources:**

1. <https://www.digimat.in/nptel/courses/video/109106124/L01.html>
2. <https://www.digimat.in/nptel/courses/video/109106138/L46.html>
3. <https://www.coursera.org/lecture/multimodal-literacies/9-2-learning-to-read-reading-for-meaning-HdG3O>
4. <https://nptel.ac.in/courses/109/107/109107172/>



**Tamil Nadu Open University**  
**Department of Chemistry**  
**School of Sciences**  
**Chennai - 15**

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**B. Sc. CHEMISTRY SYLLABUS - I YEAR - I SEMESTER (Distance Mode)**

**COURSE TITLE : CHEMISTRY - I**  
**COURSE CODE : BCHES - 11**  
**COURSE CREDIT : 4**

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**COURSE OBJECTIVES (CO)**

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While studying the Chemistry - I course; the student will be able to:

- CO1.** Describe about the classification of organic compounds
- CO2.** Naming the organic compounds and to know the factors influencing the electron availability
- CO3.** Explain the modern periodic table and its periodic properties
- CO4.** Able to classify the types and properties of chemical bonds
- CO5.** Explain the theories and properties of Gases

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**COURSE OUTCOMES (COC)**

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After completion of the Chemistry - I, the student will be able to:

- COC1.** Classify the organic compounds
- COC2.** Naming the organic compounds and to know about the factors influencing the electron availability
- COC3.** Explain the modern periodic table and its periodic properties
- COC4.** Define the types and properties of chemical bonds
- COC5.** Describe the theories and properties of Gases

**Block I: Classification of Organic Compounds**

**Unit-1-** Classification based on the nature of carbon skeleton and functional groups and C and H atoms of organic compounds (Primary, Secondary and Tertiary).

**Unit-2-** IUPAC system of nomenclature of alkanes, alkenes, alkynes, cycloalkanes, and aromatic compounds.

**Unit-3-** Factors influencing electron availability - Inductive effect, Electromeric effect, Resonance effect, Mesomerism, Hyperconjugation and Steric effect.

## **Block II: Naming of Organic Compounds**

**Unit-4-** Naming of organic compounds with one functional group - alcohols, phenol, aldehydes, ketones, carboxylic acids, cyano compounds, amines, nitro compounds. (Both aliphatic and aromatic).

**Unit-5-** Naming of organic compounds with two functional groups, more than one carbon chain and one/two hetero atoms present in five and six membered rings.

**Unit-6-** Resonance structures - drawing, conditions and stability of resonance structures.

## **Block III: Modern Periodic table and Periodic properties**

**Unit-7-** Mendeleef's classical and Moseley's modern periodic laws - Rows and Periods.

**Unit-8-** Classification of elements based on electronic configuration - s, p, d & f block elements.

**Unit-9-** Elementary idea of atomic size, atomic radii, ionic radii, shielding effect, bond angle, bond length, ionization energy, electronegativity, electron affinity - their trends along periods and groups.

## **Block IV: Chemical bonding**

**Unit-10-** Ionic bond - properties of ionic compounds and factors favoring the ionic compounds

**Unit-11-** Covalent bond - Lewis theory - Octet rule- covalent character of ionic compounds - Fajan's rules - Hydrogen bonding and its properties.

**Unit-12-** Intermolecular forces - London forces - van der Waals forces - ion dipole-dipole interactions.

## **Block V: Gaseous state**

**Unit-13 -** Ideal gas laws - van der Waals gases - van der Waals equation and determination of van der Waals constants and critical constants - relation between van der Waals constants and critical constants.

**Unit-14-** Concept of ideal gas: Gas laws, Kinetic theory of gases - Viscosity and surface tension - Newton's formula - Stoke's formula- molecular theory of surface tension - spherical and cylindrical drops - surface energy - capillary rise.

### **Text Books:**

1. A text book of Organic Chemistry by R.K. Bansal, NEW AGE; 5th edition edition (2007).
2. Principles of Inorganic Chemistry by B.R. Puri and L.R. Sharma, Milestone Publishers & Distributors/ Vishal Publishing Co.; 33rd edition edition (2017) .
3. Inorganic Chemistry by P.L. Soni, Sultan Chand & Sons (2013).

4. Principles of Physical Chemistry B.R. Puri, L.R. Sharma and M.S. Pathania, Vishal Publishing Co.; 47th edition (2017).
5. A text book of Physical Chemistry by P.L. Sony, O.P.Dharmarha and U.N. Dash Sultan Chand, Sultan Chand & Sons - Tb, (2013).
6. A text book of Organic Chemistry, B.R. Puri, H.M. Chawla.
7. Organic Chemistry by P.H.Pine, McGraw Hill.

**Reference Books:**

1. Fundamentals of Organic Chemistry by T.W.Graham Solomen, John Wiley & Sons; 4<sup>th</sup> edition (1994).
2. Principle of organic synthesis- R.O.C. Norman and J. M. Coxon.(ELBS).
3. Advanced organic chemistry (McGraw-Hill) J. March.
4. Inorganic Chemistry, J.E. Huheey, Harper and Collins, NY, IV Edition, (2010).
5. Concise Inorganic Chemistry, J. D. Lee, Wiley; Fifth Edition edition (2016).
6. Principles of Physical chemistry, P.W. Atkins, C.J. Clougston, Longman, (1986).

**Web Links:**

1. <https://youtu.be/pI0xzCfF0Yc>
2. [https://youtu.be/TYU\\_JluleME](https://youtu.be/TYU_JluleME)
3. <https://youtu.be/5BSQG2sbrQw>
4. <https://youtu.be/m9jM8IWxrAE>
5. <https://youtu.be/jb2i8QdNL24>
6. <https://youtu.be/2N117Q1UozI>
7. <https://youtu.be/n8ok1tfpyS8>
8. <https://youtu.be/b6YbRo-D4D8>
9. <https://youtu.be/DcO6HHfr9To>
10. [https://youtu.be/rX6GYo2bS\\_U](https://youtu.be/rX6GYo2bS_U)
11. [https://youtu.be/GhzaIBBM\\_Og](https://youtu.be/GhzaIBBM_Og)
12. <https://youtu.be/QdwzMPwPA3I>
13. <https://youtu.be/0AsD1I5cTP8>
14. <https://youtu.be/WBk7mGb7TKw>





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**B. Sc. CHEMISTRY SYLLABUS - I YEAR - I SEMESTER (Distance Mode)**

**COURSE TITLE : ANIMAL DIVERSITY**  
**COURSE CODE : BZOOSA - 11**  
**COURSE CREDIT : 3**

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**COURSE OBJECTIVES (CO)**

While studying the Animal Diversity course, the student shall be able to:

- CO1.** Gain the knowledge about classification of animals.
- CO2.** Elaborate study about the paramecium and earthworm.
- CO3.** Elaborate the Lamellidens and Sea star.
- CO4.** Basic concept of various physiological, anatomical structures of animals.
- CO5.** Analysis the biological concepts of birds and mammals.

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**COURSE OUTCOMES (COC)**

After completion of the Animal Diversity, the student will be able to:

- COC1.** Classify the major invertebrate and Chordates.
- COC2.** Detail about paramecium and earthworm.
- COC3.** Explain the Lamellidens and Sea star.
- COC4.** Comparative study of digestive system, respiratory system, circulatory system, urinogenital system and brain of Shark, Frog and Calotes.
- COC5.** Elaborate the circulatory system, urinogenital system and brain of Pigeon and Rabbit.

**BLOCK- I CLASSIFICATION OF MAJOR INVERTEBRATE ORGANISMS**

**Unit-1-** Classification of major Invertebrate organisms

**Unit-2-** Phylum chordata up to classes

**Unit-3-** Class characteristics and diversity with suitable examples

**BLOCK- II PARAMOECIUM, EUGLENA, OBELIA, FASCIOLA HEPATICA AND EARTHWORM**

**Unit-4-** Detailed study of *Paramoecium*

**Unit-5-** Detailed study of *Euglena*

**Unit-6-** Detailed study of *Obelia*

**Unit-7-** Detailed study of *Fasciola hepatica*

**Unit-8-** Detailed study of Earthworm

**BLOCK- III PRAWN, LAMELLIDENS AND SEA STAR**

**Unit-9-** Detailed study of Prawn

**Unit-10-** Detailed study of Lamellidens

**Unit-11-** Detailed study of sea star

**BLOCK- IV SHARK, FROG AND CALOTES**

**Unit-12-** Detailed study of external features, digestive system, respiratory system, circulatory system, urinogenital system and brain of shark

**Unit-13-** Detailed study of external features, digestive system, respiratory system, circulatory system, urinogenital system and brain of frog

**Unit-14-** Detailed study of external features, digestive system, respiratory system, circulatory system, urinogenital system and brain of calotes

**BLOCK- V PIGEON AND RABBIT**

**Unit-15-** Detailed study of external features, digestive system, respiratory system, circulatory system, urinogenital system and brain of pigeon

**Unit-16-** Detailed study of external features, digestive system, respiratory system, circulatory system, urinogenital system and brain of rabbit

**Reference:**

1. Ekambaranatha Ayyar, M. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol. 1 (Invertebrata), parts I and II. S. Viswanathan (Printers and Publishers) Pvt. Ltd; Madras.
2. Jordan, E.L. and P.S. Verma, 1993. Invertebrate Zoology, 12th Edition. S. Chand and Co. Ltd, New Delhi. 26
3. Kotpal, R.L. 1988 - 1992 Protozoa, Porifera, Coelenterata, Helminthes, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.



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**B. Sc. CHEMISTRY SYLLABUS - I YEAR - I SEMESTER (Distance Mode)**

**COURSE TITLE : OFFICE AUTOMATION**  
**COURSE CODE : BCAS-13**  
**COURSE CREDIT : 2**

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**COURSE OBJECTIVES (CO)**

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While studying the Office Automation course, the student shall be able to:

**CO1.** Know about the history, generation, applications, advantages, characters and memory units of Computers

**CO2.** Know about the introduction of word documents, formatting pages, paragraphs and shortcut keys

**CO3.** Understand the basics of MS Excel, menus, tool bars and spreadsheets.

**CO4.** Acquire knowledge on the introduction to MS Power Point, its templates, creating and formatting the presentation

**CO5.** Get awareness on the characteristics of Internet and E.mail.

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**COURSE OUTCOMES (COC)**

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After completion of the Office Automation course, the student will have the ability to:

**COC1.** Understand the history, generation, applications, advantages, characters and memory units of Computers

**COC2.** Get awareness on the introduction of word documents, formatting pages, paragraphs and shortcut keys

**COC3.** Understand the basics of MS Excel, menus, tool bars and spreadsheets

**COC4.** Acquire knowledge on the introduction to MS Power Point, its templates, creating and formatting the presentation

**COC5.** Get knowledge on the characteristics of Internet and E.mail.

## **Block I: Basics of Computer**

**Unit -1-** History & Generation of Computer, Applications of Computer, Advantages of Computer, Characteristics of Computer, Memory Units.

## **Block II: MS-Word**

**Unit -2-** Introduction to word –working with documents

**Unit -3-** Formatting page – formatting paragraph- shortcut keys

## **Block III: MS-Excel**

**Unit -4-** MS-Excel: Basics – Menus – Tool Bars

**Unit -5-** Working with spreadsheets- shortcut keys.

## **Block IV: MS-Powerpoint**

**Unit -6-** Introduction to presentation – Templates – Layouts

**Unit -7-** Creating and Formatting presentation.

## **Block V: Introduction to Internet and E.Mails**

**Unit-8-** World Wide Web (www) - History, Working-Web Browsers and its functions, Concept of Search Engines, Searching the Web. **E-Mail:** Creating an email-ID, e-mail reading, saving, printing, forwarding and deleting the mails, checking the mails, viewing and running file attachments, addressing with cc and bcc.

### **Text Books:**

1. Sanjay Saxena, MS-Office 2000 for everyone, Vikas Publishing House Pvt. Ltd, Reprint 2006.

### **Reference Books:**

1. Nellai Kannan, MS-Office, Nels Publications, 3rd Edition, 2004.
2. John Walkenbach, Herb Tyson, Michael R.Groh, Faithe Wempen and Lisa A.Bucki , Microsoft Office 2010 Bible, Wiley India Pvt. Ltd , Reprint 2010.







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## B. Sc. CHEMISTRY SYLLABUS - I YEAR - II SEMESTER (Distance Mode)

COURSE TITLE	:	Foundation in English-II (Literature and Use of English)
COURSE CODE	:	BFEGS-21
COURSE CREDIT	:	3

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### COURSE OBJECTIVES (CO)

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While studying this course, the student will be able to:

CO1. To cultivate the creativity among the learners

CO2. To improve the reading skills of the learners

CO3. To enhance the vocabulary of the learners

CO4. To develop pronunciation skills

CO5. To imbibe the use of internet for developing language skills

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### COURSE OUTCOMES (COC)

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On successful completion of the Course, the learners will be able to:

COC1. Critically evaluate the literary texts

COC2. Read the passages effectively

COC3. Speak with good accent

COC4. Communicate through online

#### **Block-1 Literary Texts**

Rabindranath Tagore's *Sacrifice* and John Donne's *The Sun Rising*

#### **Block- 2 Reading Comprehension**

Reading passages-Preparing a glossary from passage- reading the meaning- respond to questions

#### **Block- 3 Vocabulary and Grammar**

Synonyms and Antonyms- Homophones-Making of Nouns-Making of Adjectives

Compound Words-Phrases and Idioms-Words often confused-Spelling- Tenses

#### **Block-4 Pronunciation and Spoken English**



Importance of English-Pronunciation: An Exposition-Speech Sounds-Sounds and Spelling: The Relationship-Attributes of Good Speech-Dialogue Situations/ Situational Dialogues

### **Block-5 The Internet English**

Email-Chat Groups-Virtual Words-The Web-Commentary

#### **References:**

1. Balasubramanian T. *English Phonetics for Indian Students - A Workbook*. 2016.
2. Daniel Jones. *Cambridge English Pronouncing Dictionary*. Cambridge University Press, 2011.
3. Tagore, Rabindranath. *Sacrifice and Other Plays*. Niyogi Books, 2012.

#### **Web Resources:**

1. <https://www.poetryfoundation.org/podcasts/75363/the-sun-rising>
2. <https://nptel.ac.in/courses/109/103/109103135/>
3. <https://nptel.ac.in/content/storage2/courses/109106085/downloads/03-%20Phonetics%20and%20Phonology-%20week%203.pdf>
4. <https://nptel.ac.in/courses/109/106/109106085/>
5. <https://nptel.ac.in/courses/109/107/109107172/>



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**COURSE TITLE** : **CHEMISTRY - II**  
**COURSE CODE** : **BCHE- 21**  
**COURSE CREDIT** : **4**

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### **COURSE OBJECTIVES (CO)**

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While studying the Chemistry - II course, the student will be able to:

**CO1.** Describe the atomic orbitals and their overlapping concepts

**CO2.** Discuss the chemistry of addition and eliminations reactions

**CO3.** Interpret the liquid state of molecules and their properties

**CO4.** Explain the types and applications of pesticides, insecticides, fungicides, repellants, fertilizers and petrochemicals

**CO5.** Analyze the bond disconnections and its properties

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### **COURSE OUTCOMES (COC)**

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After completion of the Chemistry - II course, the student will be able to:

**COC1.** Describe the atomic orbitals and their overlapping concepts

**COC2.** Explain about the chemistry of addition and eliminations reactions

**COC3.** Discuss the liquid state of molecules and their properties

**COC4.** Categorize the types and applications of pesticides, insecticides, fungicides, repellants, fertilizers and petrochemicals

**COC5.** Acquire knowledge on the bond disconnections and its properties

## **Block I: Atomic orbitals and Hybridization**

**Unit-1-** Introduction to atomic orbitals - Quantum numbers - Principal, Azimuthal, Magnetic and Spin quantum numbers and their significances. 34

**Unit-2-** Pauli's exclusion principle - Hund's rule - Aufbau Principle, (n+1) rule - Stability of half-filled and fully filled orbitals - inert pair effect - VSEPR theory.

**Unit-3-** Hybridization - orbitals overlapping -  $sp$ ,  $sp^2$ ,  $sp^3$ ,  $dsp^2$ ,  $dsp^3$ ,  $d^2sp^3$ ,  $sp^3d^2$  and  $sp^3d^3$  - MO Theory - bonding and anti-bonding orbitals - Comparison of VB and MO theories.

## **Block II: Addition and Elimination reactions**

**Unit-4-** General introduction to addition reactions - chemistry of C-C and C=C addition reactions - simple electrophilic and nucleophilic addition reactions - 1, 3- dipolar addition - Micheal addition - hydroxylation - hydroboration - Mannich - Wittig - Stobbe - Benzoin condensation.

**Unit-5-** General introduction to eliminations reactions - chemistry of  $E_1$  and  $E_2$  elimination reactions - Chugaev reaction - Cope elimination - Hofmaan degradation.

## **Block III: Liquid state**

**Unit-6-** Nature of cohesive forces in liquids - Vaporization of liquids and their characteristics Trouton's rule and its significance.

**Unit-7-** Surface Tension and Viscosity - Influence of temperature on surface tension and viscosity - molecular, atomic and structural viscosities - Refraction, Refraction Index, Specific Refractive Index - Molar, atomic and structural refractions.

**Unit-8-** Liquid crystals -theory, types and applications of liquid crystals.

## **Block IV: Industrial chemistry**

**Unit-9-** Definition and examples for Pesticide, Insecticides, Fungicides, Repellants and Fertilizers - Inorganic pesticides: Lead arsenate, Paris green, Lime, sulphur, hydrocyanic acid - organic pesticides: DDT and Gammexane.

**Unit-10-** Fertilizer: Nutrients for plant and role of various elements in plants growth - Natural fertilizers - chemical fertilizers - classification of chemical fertilizers: Urea, Super phosphate and Potassium nitrate.

**Unit-11-** Petrochemicals - Introduction - Definition - Origin - Composition - Chemical from natural gas, light Naphtha, petroleum, and Kerosene - Synthetic Gasoline.

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## **Block V: Disconnection of bonds**

**Unit-12-** Introduction to homolysis and heterolysis disconnections - definition and stability of carbocations, carbanions and radicals - preparations, physical properties and simple reactions of alkanes, alkenes and alkynes.

**Unit-13-** Mechanism of addition on alkenes - addition of hydrogen, halogen, hydrogen halide, hydroboration, hydroxylation, Ozonolysis and epoxidation.

**Unit-14-** Preparations and reactions of cycloalkanes - cyclo addition, dehalogenation, and Wurtz reaction - 1,2 and 1,4 addition - Diels-Alder reaction - stability of cycloalkanes.

### **Text Books:**

1. Physical Chemistry by G.M. Barrow, International Student Edition, McGraw Hill.
2. Advanced Inorganic Chemistry by SatyaPrakash, 17<sup>th</sup> edition.
3. A text book of Organic Chemistry by R.K. Bansal.
4. Inorganic Chemistry by G.C. Shivhare and V.P. Lavania.
5. Physical Chemistry, Bahl and Tuli, S. Chand & Co (P) Ltd.
6. A text book of Organic Chemistry by M.K. Jain.
7. Inorganic Chemistry by P.L. Soni.
8. Modern Inorganic Chemistry by R.C. Agarwal.
9. Physical Chemistry, R.A. Alberty, Wiley Eastern Ltd.
10. Basic principle of Organic Stereochemistry by Dr. P. Ramesh.
11. Stereochemistry, Conformation and mechanisms by Kalsi, Wiley- Eastern Ltd.

### **Reference Books:**

1. Fundamentals of Organic Chemistry by T.W. Graham Solomen, John Wiley & Sons; 4<sup>th</sup> edition (1994).
2. Principle of organic synthesis- R.O.C. Norman and J. M. Coxon. (ELBS).
3. Advanced organic chemistry (McGraw-Hill) J. March.
4. Inorganic Chemistry, J.E. Huheey, Harper and Collins, NY, IV Edition, (2010).
5. Concise Inorganic Chemistry, J. D. Lee, Wiley; Fifth Edition edition (2016)
6. Principles of Physical chemistry, P.W. Atkins, C.J. Clougston, Longman, (1986).

### **Web Links:**

1. <https://youtu.be/B-DpIhedGmk>

2. <https://youtu.be/GmN1hF5Sng0>
3. <https://youtu.be/C2mGEnQ1Y54>
4. <https://youtu.be/6BrsdhuImlg>
5. <https://youtu.be/B494VE1IVfo>
6. <https://youtu.be/EsxJDaEKlkw>
7. <https://youtu.be/lz7Xf5gKFcs>
8. [https://youtu.be/JY42FFz\\_zPs](https://youtu.be/JY42FFz_zPs)
9. <https://youtu.be/oAXMlsG9UQI>
10. <https://youtu.be/7Tlzzr9nBP8>
11. [https://youtu.be/\\_T36oYc7Oag](https://youtu.be/_T36oYc7Oag)
12. <https://youtu.be/hDT3klGQDzU>
13. <https://youtu.be/N06uXaIKDPQ>
14. <https://youtu.be/JoG4XZ-ItF4>



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**COURSE TITLE : ECONOMIC ZOOLOGY**

**COURSE CODE : BZOOSA-22**

**COURSE CREDIT : 3**

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### **COURSE OBJECTIVES (CO)**

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While studying the Economic Zoology course, the student shall be able to:

**CO1.** Import the knowledge about the basic concepts of insect vectors.

**CO2.** Learners are taught about fish culture,

**CO3.** Elaborate the freshwater fish culture.

**CO4.** Gain the knowledge about prawn culture, apiculture etc.,

**CO5.** Gain disease management of sericulture, fisheries, apiculture, poultry etc.,

**CO6.** Gain the knowledge about migrations of bird and fishes.

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### **COURSE OUTCOMES (COC)**

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After completion of the Economic Zoology, the student will be able to:

**COC1.** Demonstrate the basic concepts of insect vectors.

**COC2.** Learners are taught about fish culture, prawn culture, apiculture etc.,

**COC3.** Gain knowledge about disease management of sericulture, fisheries, apiculture, poultry etc.

**COC4.** Explore various concepts and the importance of economic zoology.

**COC5.** Explain the freshwater fish culture.

### **BLOCK I BENEFICIAL AND HARMFUL INSECTS**

Unit -1. Beneficial and harmful insects, including insect vectors of human diseases (Mosquito and Lice)

Unit -2. Pests of sugar cane (*Pyrrilla perpusilla*)

Unit -3. Pests of oil seeds (*Achaea janata*)

Unit -4. Pests of rice (*Sitophilus oryzae*)

### **BLOCK II AQUACULTURE**

Unit -5. Aquaculture: Principles, definition and scope

Unit -6. Exotic fishes - their merits and demerits

Unit -7. Basic principles of different aquaculture system (Polyculture and integrated farming)

Unit -8. Culture of prawn

Unit -9. Pearl culture

### **BLOCK III APICULTURE**

Unit -10. Apiculture: Development of apiary in India

Unit -11. Types of honey bees

Unit -12. Modern methods of apiary management

Unit -13. Products and its uses

Unit -14. Problems and prospects

### **BLOCK IV SERICULTURE**

Unit -15. Sericulture: Life history and rearing of *Bombyx mori*, harvesting & processing of cocoon, reeling and extraction of silk

Unit -16. Diseases of silkworms of *Bombyx mori* and control measures

### **BLOCK V POULTRY FARMING**

Unit -17. Poultry: Fowl -Types of breeds

Unit -18. Rearing of Fowl

Unit -19. Disease management

### **REFERENCES:**

1. **AYYAR, E.K. & T.N. ANANTHAKRISHNAN** (2000), Manual of Zoology Vol. I & II (Non - Chordata and Chordata), S. Viswanathan (Printers and Publishers) Pvt. Ltd., Madras.
2. **SHUKLA & UPADHYAY** (2014) Economic Zoology, 5<sup>th</sup> Edition, Rastogi Publication, Meerut, New Delhi.
3. **KOTPAL, R.L** (2000), Modern Textbook of Zoology, Rastogi Publications (2000) Meerut, New Delhi.



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**COURSE TITLE** : **VOLUMETRIC ANALYSIS**  
**COURSE CODE** : **BCHEP-P1**  
**COURSE CREDIT** : **4**

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**COURSE OBJECTIVES (CO)**

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While studying the Volumetric analysis practical course, the student shall be able to:

**CO1.** Know about the acidimetry and alkalimetry titrations in which how the given solutions are estimated

**CO2.** Understand the iodometry titrations in which how given compounds are estimated

**CO3.** Acquire knowledge on the permanganometry titration in which how given compounds and ions are estimated

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**COURSE OUTCOMES (COC)**

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After completion of the Volumetric analysis practical course, the student will have the ability to:

**COC1.** Gain knowledge on the acidimetry and alkalimetry titrations in which how given solutions are estimated

**COC2.** Get awareness on the iodometry titrations in which how given compounds are estimated

**COC3.** Understand the permanganometry titration in which how given compounds and ions are estimated

**VOLUMETRIC ANALYSIS (BCHEP-01)**

A double titration involving the making up of the solution to be estimated and the preparation of a primary standard.

**1. ACIDIMETRY & ALKALIMETRY**

1. Estimation of NaOH



2. Estimation of Oxalic acid

3. Estimation of  $\text{Na}_2\text{CO}_3$

## 2. IODIMETRY

1. Estimation of Copper

2. Estimation of  $\text{K}_2\text{Cr}_2\text{O}_7$

## 3. PERMANGANOMETRY

1. Estimation of Ferrous ion

2. Estimation of Oxalic acid

### Distribution of marks

Results = 30 marks

Record = 15 marks

Procedure writing = 10 marks

Viva voce = 15 marks

**Total = 70 marks**

### For Errors:

1 - 2 % = 30 marks

2 - 3 % = 25 marks

3 - 4 % = 20 marks

4 - 5 % = 15 marks

>5 % = 10 marks



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## **COURSE OBJECTIVES (CO)**

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While studying this course, the student shall be able to:

- CO1. To cultivate the positive mind
- CO2. To improve body language
- CO3. To develop interview skills
- CO4. To prepare a comprehensive CV
- CO5. To enhance interpersonal skills

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## **COURSE OUTCOMES (COC)**

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On successful completion of the Course, the learners will be able to:

- COC1. Approach the life positively
  - COC2. Communicate in good manner
  - COC3. Join in a team in working place
  - COC4. Develop an impressive CV
  - COC5. Express managerial skills
- 

### **Block-1 Introduction to Soft Skills**

Soft Skills: An Introduction - Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development- Self-Discovery: Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue. 3. Positivity and Motivation: Developing Positive Thinking and Attitude; Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels.

### **Block-2 Body Language & Etiquettes**

Non-Verbal Communication: Importance and Elements; Body Language- Social and Business.

### **Block-3 Group Discussion & Interview Skills**

Interviewer and Interviewee - in-depth perspectives- Before, During and After the Interview- Tips for Success- Meaning, Types and Models, Group and Ethical Decision-Making, Problems and Dilemmas in application of these skills

#### **Block-4 Preparation of Curriculum Vitae' (CV)**

Definition of CV and its purposes- CV versus Resume- Rules- Covering Letter

#### **Block-5 Emotional Intelligence Skills**

Meaning, History, Features, Components, Intrapersonal and Management Excellence; Strategies to enhance Emotional Intelligence.

#### **References:**

1. Dhanavel S.P. *English and Soft Skills*. Orient Blackswan India, 2010.
2. Ghosh B.N. (Ed.) *Managing Soft Skills for Personality Development*. McGraw Hill India, 2012.

#### **Web Resources:**

1. [https://onlinecourses.nptel.ac.in/noc19\\_hs33/preview](https://onlinecourses.nptel.ac.in/noc19_hs33/preview)
2. <https://nptel.ac.in/courses/109/107/109107121/>



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**COURSE CODE : BCHES-31**

**COURSE CREDIT : 4**

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### **COURSE OBJECTIVES (CO)**

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While studying the Chemistry - III course, the student will be able to:

**CO1.** Determine the characteristic features of s-block elements

**CO2.** Discuss the characteristic of Boron and Carbon families in the p-block elements

**CO3.** Interpret the characteristic features and types of substitution reactions

**CO4.** Describe the characteristic features of kinetics of the chemical reactions

**CO5.** Explain about the classification, synthesis and structures of Terpenoids and Alkaloids

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### **COURSE OUTCOMES (COC)**

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After completion of the General Chemistry - III course, the student will be able to:

**COC1.** Explain the characteristic features of the elements in s-block

**COC2.** Interpret the characteristic features of Boron and Carbon families in the p-block elements

**COC3.** Describe the characteristic features and types of substitution reactions

**COC4.** Discuss the characteristic features of kinetics of the chemical reactions

**COC5.** Define the classification, synthesis and structures of Terpenoids and Alkaloids.

### **Block I: s-block elements**

**Unit-1-** General characteristic features of s-block elements - compounds of s-block metals oxides, hydroxides and peroxides - preparation and properties of carbonates, bicarbonates, nitrates and halides.

**Unit-2-** Anomalous behavior of Li and Be - extraction, physical, chemical properties and uses of beryllium - organometallic compounds of Li and Be.

**Unit-3-** Physical chemical properties and uses of Mg - biological importance of sodium and potassium.

### **Block II: p-block elements (Boron and Carbon families)**

**Unit-4-** General characteristic features of p-block elements and elements of Group III A  
Compounds of boron: Borax, Boric acid, Diborane and Boron nitride.

**Unit-5-** Extraction, chemical properties and uses of Aluminium - compounds of Aluminium -  $\text{Al}_2\text{O}_3$ ,  $\text{AlCl}_3$ , Alums - Alloys of Aluminium.

**Unit-6-** General characteristics features of elements of Group III A - Allotropic forms of carbon - chemistry of Charcoal - physical, chemical properties and uses of Si - structures of silicates-chemistry of silicones - types and manufacture of glass - ceramics.

### **Block III: Substitution reactions**

**Unit-7-** General characteristics of aromatic electrophilic substitution reaction - Characteristics of ortho, meta and para directing groups with examples - Synthetic application of nitration, sulphonation, and halogenation.

**Unit-8-** Friedal's Craft's alkylation and arylation - Riemer-Tiemann reaction - Gattermann-Koch reaction - Vilsmeier Haack reaction.

**Unit-9-** General characteristics of Aromatic nucleophilic substitution reaction - substitution involving diazonium ions - Ziegler alkylation - Chichibabin reaction.

### **Block IV: Reaction Kinetics**

**Unit-10-** Definition for Order and Molecularity - methods to determine the rate of reactions - Derivation of rate constants for I, II, III and Zero order reactions and examples - Methods to determine the order of reactions - effect of temperature on the rate of reactions.

**Unit-11-** Arrhenius equation and concept of energy of activation - Collision theory and derivation of rate constant for bimolecular reactions - theory of absolute reaction rates.

**Unit-12-** Thermodynamic derivation for the rate constant for a bimolecular reaction - comparison of collision theory and ARRT - Significance of entropy and free energy of activation.

### **Block V: Terpenoids and Alkaloids**

**Unit-13-** Introduction and classification of terpenes and terpenoids - isoprene rule - Synthesis and structural elucidation of citral, limonene, menthol,  $\alpha$ -terpineol and camphor

**Unit-14-** Introduction and classification of alkaloids - General methods for the determination of structure of alkaloids - Synthesis and structural elucidation of conine, piperine and nicotine.

### **Text books:**

1. Advanced Inorganic Chemistry by S.P.Banerjee, Volume I & II.
2. A text-book of Pharmaceutical Chemistry & Medicinal Chemistry by Raghupati Mukhopadhyay, Sriparna Datta and Rajib Kumar Das. 48
3. Advanced Organic Chemistry by B.S. Bahl, ArunBahl and S.Chand.
4. Principles of Inorganic Chemistry by B.R. Puri, L.R. Sharma and ShobanlalNagin Chand.
5. A text book of Physical Chemistry by P.L.Soni, D.B. Dharmarke and Sultan Chand.



6. Inorganic Chemistry by P.L.Soni and Sultan Chand.
7. Organic Chemistry by S.M. Mughergee, S.P. Singh, R.P. Kapoor and Wiley Eastern Volume. I, II & III.
8. Essentials of Physical Chemistry by B.S. Bahl, G.D. Tuli, and S.Chand.

### **Reference Books**

1. Inorganic Chemistry, J.E. Huheey, Harper and Collins, NY, IV Edition, (2010).
2. Concise Inorganic Chemistry, J. D. Lee, Wiley; Fifth Edition edition (2016).
3. Organic Chemistry, R. T. Morrison, R. N. Boyd, Prentice Hall; 6th edition (1992).
4. Pearson House, Fundamentals of Chemical Kinetics ,Createspace Independent Pub; 1st edition (2017).
5. K.J. Laidler, Chemical Kinetics, Pearson; 3 edition (1997).
6. Organic Chemistry Vol 2, I. L. Finar, Pearson.

### **Web Linkss**

1. <https://youtu.be/kEQ8z9UFNa0>
2. <https://youtu.be/MiW4-XtEhMs>
3. <https://youtu.be/qC-2dOP2FTg>
4. <https://youtu.be/EijNYsp9s8k>
5. <https://youtu.be/tsWQYMnBKl0>
6. <https://youtu.be/0hcRLZfh5UE>
7. <https://youtu.be/I8qsSgUDZZk>
8. <https://youtu.be/yKccrM-Ayr8>
9. <https://youtu.be/bEEnD7LFHF0>
10. <https://youtu.be/g7jmTgqOVZ8>
11. <https://youtu.be/jX4dEOFwaLQ>
12. <https://youtu.be/jX4dEOFwaLQ>
13. <https://youtu.be/l2LymcI096Q>



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COURSE CODE : BPHYSA - 11

COURSE CREDIT : 3

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### COURSE OBJECTIVES (CO)

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While studying the Allied Physics-I, the Learner shall be able to:

**CO1.** To learn the basic concepts of physics

**CO2.** To understand the fundamentals of Waves, Properties of matter, Heat, Electricity and Magnetism.

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### COURSE OUTCOMES (COC)

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After completion of the Allied Physics-I, the Learner will be able to:

**COC1.** Demonstrate conceptual understanding of the fundamental Physics principles.

Identify various properties responsible for their behavior

**COC2.** Understand the concept of elasticity and identify the materials suitable for a particular application

**COC3.** Apply the basic laws of mechanics to understand the working of simple machines.

**COC4.** Appreciate the usage of the basic concepts of Physics in everyday life

### **BLOCK I: Waves and Oscillations**

Simple harmonic motion – composition of two simple harmonic motion at right angles (periods in the ratio 1:1) – Lissajou’s figures – uses. laws of transverse vibrations of strings – Melde’s string – transverse and longitudinal modes -Sonometer-determination of a.c frequency using sonometer (steel and brass wires). Ultrasonics – production – application and uses – reverberation – factors for good acoustics of hall and auditorium.

### **BLOCK II: Properties of matter**

Elasticity : Elastic constants – bending of beam – Young’s modulus by non- uniform bending. 50

Energy stored in a stretched wire – torsion in a wire – determination of rigidity modulus by torsional pendulum – static torsion. Viscosity: Coefficient of viscosity – Poissuelle’s formula – comparison of viscosities - burette method – Stoke’s law – terminal velocity – viscosity of highly viscous liquid – lubrication. Surface tension: Molecular theory of

surface tension – excess of pressure inside a drop and bubble – variation of surface tension with temperature – Jaeger’s method.

### **BLOCK III : Thermal Physics**

Joule-Kelvin effect – Joule-Thomson porous plug experiment – theory and application. - liquefaction of gasses – Linde’s process – Helium I and II – adiabatic demagnetization. Thermodynamic equilibrium – laws of thermodynamics – entropy change of entropy in reversible and irreversible processes.

### **BLOCK IV: Electricity and Magnetism**

Capacitor – energy of a charged capacitor - loss of energy due to sharing of charges – Magnetic field due to a current carrying conductor – Biot Savart’s Law – Field along the axis of the coil carrying current. AC current: peak, average and RMS values of ac current and voltage – power factor and current values in an ac circuit. Circuit control and protective devices -switch and its types – fuses circuit breaker and relays.

### **BLOCK V: Geometrical optics**

Refraction – Refractive index by microscopy – air cell – refraction at grazing incidence and grazing emergence in prisms – Dispersion-combination of two small angled prisms to produce dispersion without deviation and deviation without dispersion – direct vision prism – constant deviation prism – defects of images – coma – distortion. Lens: spherical and chromatic aberration in lenses.

### **Books for study**

1. Allied Physics by R. Murugesan, S.Chand & Co, New Delhi(2008).  
Waves and Oscillations by Brijlal and N. Subramanyam, Vikas Publishing house, New Delhi.
2. Properties of Matter by Brij Lal and N.Subramaniam, S. Chand & Co., New Delhi(1994).
3. Heat and Thermodynamics by J.B.Rajam and C.L.Arora, S.Chand & Co., 8<sup>th</sup> edition, New Delhi(1976).
4. Optics and Spectroscopy by R. Murugesan, S.Chand & Co, New Delhi, (2005).

### **Books for Reference**

1. Fundamentals of Physics by Resnick Halliday and Walker, John Willey and Sons, Asia Pvt.Ltd., 6<sup>th</sup> edition, Singapore.
2. Text book of Sound by V.R.Khanna and R.S.Bedi, Kedharnaath Publish & Co, 1<sup>st</sup> edition, Meerut (1998).
3. Electricity and Magnetism by N.S. Khare and S.S. Srivastava, Atma Ram & Sons, 10<sup>th</sup> Edition, New Delhi (1983).



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**B. Sc. CHEMISTRY SYLLABUS - II YEAR - IV SEMESTER (Distance Mode)**

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**(Course Title)**

□ □ □ □ □ □ □ □ □ □ □ □ : **BFTMS-41**

**(Course Code)**

□ □ □ □ □ □ □ □ □ □ □ □ □ □ : **3**

**(Course Credits)**







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**B. Sc. CHEMISTRY SYLLABUS - II YEAR - IV SEMESTER (Distance Mode)**

**COURSE TITLE : Foundation in English (Writing Skills)**

**COURSE CODE : BFECS- 41**

**COURSE CREDIT : 3**

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**COURSE OBJECTIVES (CO)**

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While studying this course, the student shall be able to:

**CO1.** Train the learners to write the academic essays

**CO2.** To make them learn different steps of writing

**CO3.** To develop the learners' creativity

**CO4.** To distinguish between fact and opinion, cause and effect, problem and solution, similarities and differences, general and specific ideas, and relevant and irrelevant information.

**CO5.** To convey information through written language

**CO6.** To involve in note-taking, gathering information, drafting, free-writing, revising, proofreading, and editing when engaged in writing.

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**COURSE OUTCOMES (COC)**

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On successful completion of the Course, the learners will be able to:

**COC1.** Write without mistakes

**COC2.** Draft formal and informal letters

**COC3.** Take notes for writing purpose

**COC4.** Explain the tables/ pictures in words

**COC5.** Edit the written matters

### **BLOCK-01 Basic Writing Skills**

Learn the basic paragraph structure: main idea, supporting sentences, use of examples, conclusion- Use basic sentence structures to write a paragraph; use cohesive devices to connect sentences in a paragraph; use transitional devices for cohesion and for contrast paragraph internally and between paragraphs (The above structures and devices to be consciously used in all writing tasks)- Understand and use text structures in paragraphs: sequencing, comparing and contrasting, relating cause and effect, problems and problem solving

### **BLOCK-02 Informal and Formal Communication**

Write informal letters, applications, and official letters of request and denial- Write official e-mails, memos and notices

### **BLOCK-03 Note-Making and Summarising**

Prepare notes from reading texts- Take notes from spoken texts-Summarize key ideas and information in organized points developed from the notes prepared

### **BLOCK-04 Study Skills (Information Transfer, Reference Skills)**

Use charts, tables, other graphics and multimedia, as appropriate for the written texts; present summary to a group

### **Block- 05 Technical Editing**

Technical Editing – The Big Picture- Working Collaboratively- Organization: The Architecture of Information- Visual Design and Font Selection- Editing Methods – Then and Now- The Power of Grammar, Punctuation and Spelling- Basic Copyediting<sup>56</sup> proofreading -Ethical and Legal Issues

### **References:**



1. Graham King. *Collins Improve your writing skills*
2. Norman Coe and Robin Rycroft. *Writing Skills A Problem Solving Approach*. CUP.
3. Robyn Najar and Lesley Riley. *Developing Academic Writing Skills*. Macmillan Publications.
4. Scheraga, Mona. *Practical English Writing Skills: A Complete Guide to Writing in English*

**Web Resources:**

1. <https://nptel.ac.in/courses/109/107/109107172/>
2. <https://nptel.ac.in/courses/109/104/109104031/>
3. [https://onlinecourses.swayam2.ac.in/cec20\\_ma04/preview](https://onlinecourses.swayam2.ac.in/cec20_ma04/preview)



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**B. Sc. CHEMISTRY SYLLABUS - II YEAR (IV SEMEMSTER)**

**COURSE TITLE : CHEMISTRY - IV**  
**COURSE CODE : BCHES-41**  
**COURSE CREDIT : 4**

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**COURSE OBJECTIVES (CO)**

While studying the Chemistry - IV course, the student will be able to:

**CO1.** Describe the principles, operations and processes involved in metallurgy

**CO2.** Explain about the principles and concepts involved in Green chemistry

**CO3.** Interpret the p-block elements of nitrogen, oxygen, halogen and noble gas families

**CO4.** Discuss the characteristic features of d and f-block elements

**CO5.** Determine the occurrence, classification and importance of biochemicals such as carbohydrates, vitamins, hormones, antiseptics, disinfectants, antimalarial, antibiotic analgesics, anaesthetics, antipyretics and anti-inflammatory.

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**COURSE OUTCOMES (COC)**

After completion of the Chemistry - IV course, the student will be able to:

**COC1.** Interpret the principles, operations and processes involved in metallurgy

**COC2.** Acquire knowledge on the principles and concepts involved in Green chemistry

**COC3.** Explain the p-block elements of nitrogen, oxygen, halogen and noble gas families

**COC4.** Determine the characteristic features of d and f-block elements

**COC5.** Describe the occurrence, classification and importance of biochemicals such as carbohydrates, vitamins, hormones, antiseptics, disinfectants, antimalarial, antibiotic analgesics, anaesthetics, antipyretics and anti-inflammatory.

## **Block I: Metallurgy**

**Unit-1-** Principles, operations and processes involved in metallurgy - General methods involved in extraction of metals - froth floatation, magnetic separation, calcinations, roasting, smelting, flux, and aluminothermic process.

**Unit-2-** Extraction processes - chemical reduction, electrolytic reduction and metal displacement.

**Unit-3-** Refining methods - electrolytic refining and zone refining - Distillation, fractional crystallization, electrolysis, van Arkel de Boer methods, ion exchange method and muffle furnace.

## **Block II: Green Chemistry**

**Unit-4-** Definition, need and principles of Green chemistry - Green synthesis: Aqueous phase reactions, reactions in ionic liquids, solid supported synthesis and solvent free reactions.

**Unit-5-** Definition and properties of Green catalysts - Phase transfer catalysts (PTC) and Biocatalysts - Microwave and Ultrasound assisted green synthesis - Green chemical synthesis of paracetamol.

## **Block III: p-block elements (Nitrogen, Oxygen, Halogen and Noble gas families)**

**Unit-6-** General characteristic features of elements of VA Group - Preparation, physical, chemical properties and uses of Nitrogen and Oxygen - Chemistry of  $\text{PH}_3$ ,  $\text{PCl}_3$ ,  $\text{PCl}_5$ ,  $\text{POCl}_3$  and  $\text{P}_2\text{O}_5$ . - Anomalous behavior of oxygen - chemistry of Selenium and Tellurium.

**Unit-7-** General characteristics of Halogen family - with reference of electro negativity, electron affinity, and oxidation states - Inter-halogen and pseudohalogen compounds.

**Unit-8-** General characteristics of Noble gases - position in the periodic table and uses of Noble gases - Structure and shape of xenon compounds:  $\text{XeF}_2$ ,  $\text{XeF}_4$ ,  $\text{XeF}_6$ ,  $\text{XeOF}_2$  and  $\text{XeOF}_4$ .

## **Block IV: d and f-block elements**

**Unit-9-** General characteristics, electronic configuration and uses of d-block elements - group study of titanium, vanadium, chromium, manganese and iron metals - Oxides, halides, sulphides and oxohalides of transition metals - toxicity of Cd and Hg.

**Unit-10-** General characteristics and classifications of f-block elements - Electronic configuration, oxidation states, uses and comparative account of lanthanides and actinides - lanthanide contraction

## **Block V: Biomolecules**

**Unit-11-** Carbohydrates: Monosaccharides, Disaccharides and Polysaccharides - classification, preparation, properties and structures.

**Unit-12** - Vitamins: occurrence, classification and structure - Deficiency diseases caused by Vitamin A, B complex, C, D, E and K.

**Unit-13** - Introduction to Hormones - reproductive hormones - Definition to Anti-malarial - classification and use of chloroquine and Pamaquine.

**Unit-14-** Definition to Antiseptics and Disinfectants: uses of chloramine-T, Iodoform and

Dettol - Definition to Antibiotics: uses of Penicillin, Chloromycetin, Streptomycin and Tetracycline - Definitions and examples for analgesics, anaesthetics, antipyretics and antiinflammatory.

### **Text Books:**

1. Environmental Chemistry with Green Chemistry by Asim K. Das.
2. A text book of Inorganic Chemistry by A.K. De and Wiley.
3. Concise Inorganic Chemistry by J.D. Lee.
4. Biochemistry by SC Rastogi, Edition II.
6. Inorganic Chemistry by Shriver and Atkins.
7. Green Chemistry (Environment Friendly Alternatives) by Rashmi Sanghi and M.M. Srivastava.

### **Reference Books:**

1. Inorganic Chemistry, J.E. Huheey, Harper and Collins, NY, IV Edition, (2010).
2. Concise Inorganic Chemistry, J. D. Lee, Wiley; Fifth Edition edition (2016).
3. Green Chemistry: Theory and Practice, Paul T. Anastas, John Charles Warner, Oxford University Press, (2000).
4. Organic Chemistry, R. T. Morrison, R. N. Boyd, Prentice Hall; 6th edition (1992).
5. Organic Chemistry Vol 2, I. L. Finar, Pearson.

## **Web Links:**

1. [https://youtu.be/QalAQq\\_-Z14](https://youtu.be/QalAQq_-Z14)
2. <https://youtu.be/zMLNHm4nUCQ>
3. [https://youtu.be/ViM\\_aP5BKzc](https://youtu.be/ViM_aP5BKzc)
4. <https://youtu.be/3QaY7pf-EDo>
5. <https://youtu.be/S4iwxPyVvxM>
6. <https://youtu.be/w0e3Ogusxg0>
7. <https://youtu.be/43nFNTHV5iE>
8. [https://youtu.be/fy1CTaNkf\\_Q](https://youtu.be/fy1CTaNkf_Q)
9. <https://youtu.be/uqcrNiif-S0>
10. <https://youtu.be/kEQ8z9UFNa0>
11. [https://youtu.be/7IVm\\_oEPJw4](https://youtu.be/7IVm_oEPJw4)
12. <https://youtu.be/dtCvYfhzPQ0>
13. <https://youtu.be/q1iNVvBIT6g>
14. <https://youtu.be/XYDaMySWIbA>



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**B. Sc. CHEMISTRY SYLLABUS - II YEAR - IV SEMESTER (Distance Mode)**

**COURSE TITLE : ALLIED PHYSICS - II**

**COURSE CODE : BPHYSA-22**

**COURSE CREDIT : 3**

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**COURSE OBJECTIVES (CO)**

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While studying the Allied Physics-II, the Learner shall be able to:

**CO1.** To learn the basic concepts of physics

**CO2.** To understand the fundamentals of Optics, Atomic and Nuclear Physics and Electronics.

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**COURSE OUTCOMES (COC)**

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After completion of the Allied Physics-II,, the Learner will be able to:

**COC1.** Understand the differences in the important phenomena namely interference, diffraction and Polarization and apply the knowledge in day to daylife.

**COC2.** Will be able to understand the working of analog and digital circuits.

**COC3.** To understand the basic principles of logic gates

**COC4.** Appreciate the usage of the basic concepts of Physics in everyday life

**BLOCK I : Physical Optics**

Velocity of light - Michelson's method. Interference :Colours of thin films -air wedge - determination of diameter of a thin wire by air wedge - test for optical flatness <sup>62</sup>  
Diffraction - Fresnel's explanation of rectilinear propagation of light - theory of transmission grating - Normal incidence. Polarization - double refraction - optical activity - polarimeter.

## **BLOCK II : Atomic Physics**

Atom model – vector atom model – electron, spin, quantum numbers – Pauli’s exclusion principle – Electronic configuration of elements and periodic classification of elements – various quantum numbers –Magnetic dipole moment of electron due to orbital and spin motion – Bohr magneton – spatial quantisation – Stern and Gerlach experiment.

## **BLOCK III : Nuclear Physics**

Nuclear model – liquid drop model – magic numbers - shell model –Nuclear energy – mass defect – binding energy. Radiation detectors – ionization chambers – GM Counter – Fission Controlled and Uncontrolled chain reaction – nuclear reactor – Thermonuclear reactions – stellar energy.

## **BLOCK IV: Elements of relativity and quantum mechanics**

Postulates of theory of relativity – Lorentz transformation equations – derivation – length contraction –Time dilation–Mass energy equivalence – uncertainty principle – Postulates of wave mechanics – Schrodinger’s equation – application to a particle in a box.

## **BLOCK V: Electronics**

Basic Electronics: Zener diode – voltage regulator – LED – Transistor RC coupled amplifier – feedback principle – condition for oscillation – phase shift oscillator – Wein’s bridge oscillator.

Digital Electronics: NAND and NOR gates – Universal building blocks. Boolean algebra – Demorgan’s theorem – verification – elementary ideas of ICs – SSI , MSI, LSI and VLSI – Half adder, Full adder, Half Subtractor and Full subtractor.

## **Books for study**

1. Allied Physics by R. Murugesan, S.Chand& Co, New Delhi(2008).
2. Allied Physics by K. Thangaraj and D. Jayaraman, Popular Book Depot, Chennai(2004).
3. Text book of Optics by Brijlal and N. Subramanyam, S.Chand& Co, New Delhi(2002).
4. Modern Physics by R. Murugesan, S.Chand& Co, New Delhi (2005).
5. Applied Electronics by A. Subramaniam, National Publishing Co., 2<sup>nd</sup> Edition, Chennai(2001).

## **Books for Reference**

1. Fundamentals of Physics by Resnick Halliday and Walker, John Willey and Sons, Asia Pvt.Ltd., 6<sup>th</sup> Edition, Singapore.
2. Optics by D.R. Khanna and H.R. Gulati, S. Chand & Co., New Delhi (1979).
3. Concepts of Modern Physics by A.Beiser, Tata McGraw Hill Publication, New Delhi(1997).
4. Digital Fundamentals by Thomas L.Floyd, Universal Book Stall – New Delhi (1998).



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**B. Sc. CHEMISTRY PRACTICAL SYLLABUS - II YEAR - IV SEMESTER (Distance Mode)**

**COURSE TITLE : INORGANIC SEMI-MICRO QUALITATIVE ANALYSIS**  
**COURSE CODE : BCHES-P2**  
**COURSE CREDIT : 4**

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**COURSE OBJECTIVES (CO)**

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While studying the Inorganic semi-micro qualitative analysis practical course, the student shall be able to:

**CO1.** Understand the basic terms and concepts involved in the semi-micro qualitative analysis method

**CO2.** Gain knowledge on the analysis of a mixture containing two cations and two anions by semi-micro qualitative analysis method

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**COURSE OUTCOMES (COC)**

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After completion of the Inorganic semi-micro qualitative analysis course, the student will have the ability to:

**COC1.** Acquire knowledge on the basic terms and concepts involved in the semi-micro qualitative analysis method

**COC2.** Analyze a mixture containing two cations and two anions by semi-micro qualitative analysis method



## INORGANIC SEMI-MICRO QUALITATIVE ANALYSIS

Analysis of a mixture containing two cations and two anions of which one will be an interfering ion. Semimicro methods using the conventional scheme with hydrogen sulphide may be adopted.

Cations to be analyzed: Copper, Nickel, Cobalt, Zinc, Lead, Bismuth, Cadmium, Iron, Aluminum, Manganese, Barium, Calcium, Strontium, Magnesium and Ammonium.

Anions to be analyzed: Fluoride, Chloride, Bromide, Carbonate, Nitrate, Sulphate, Oxalate and Phosphate.

### Distribution of marks

4 Radicals	= 40 marks (4 x 10)
Record	= 10 marks
Procedure writing	= 10 marks
Viva voce	= 10 marks



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**B. Sc. CHEMISTRY SYLLABUS - II YEAR - IV SEMESTER (Distance Mode)**

**COURSE TITLE : ENVIRONMENTAL SCIENCE**

**COURSE CODE : CCE**

**COURSE CREDIT : 2**

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**COURSE OBJECTIVES (CO)**

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While studying the Environmental Science course, the Learner shall be able to:

**CO1.** To help students to gain the fundamental knowledge of the environment

**CO2.** To create in students an awareness of current environmental issues

**CO3.** To inculcate in students an eco-sensitive, eco-conscious and eco-friendly attitude.

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**COURSE OUTCOMES (COC)**

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After completion of the Environmental Science course, the Learner will be able to:

**COC1.** Articulate the interdisciplinary context of environmental issues

**COC2.** Adopt sustainable alternatives that integrate science, humanities and social perspectives

**COC3.** Appreciate the importance of biodiversity and a balanced ecosystem

Calculate one's carbon print

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**Unit 1: Multidisciplinary nature of environmental studies:** Definition, scope and importance - Need for public awareness

**Unit 2: Natural Resources:**

• Renewable and non-renewable resources: Natural resources and associated problems

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

### **Unit 3: Ecosystems:**

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following ecosystem: - a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (6 lectures)

### **Unit 4: Biodiversity and its conservation:**

- Introduction – Definition: genetic, species and ecosystem diversity.
- Biogeographical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values • Biodiversity at global, National and local levels.
- India as a mega-diversity nation
- Hot-spots of biodiversity.
- Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. (8 lectures)

### **Unit 5 : Environmental Pollution:**

- Definition
- Cause, effects and control measures of: - a. Air pollution b. Water pollution c. Soil pollution
- d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

- Role of an individual in prevention of pollution.
- Pollution case studies.
- Disaster management: floods, earthquake, cyclone and landslides.

#### **Unit 6: Social Issues and the Environment:**

- From Unsustainable to Sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case Studies
- Environmental ethics: Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust- Case Studies.
  - Wasteland reclamation.
  - Consumerism and waste products.
  - Environment Protection Act.
  - Air (Prevention and Control of Pollution) Act.
  - Water (Prevention and control of Pollution) Act
  - Wildlife Protection Act
  - Forest Conservation Act
  - Issues involved in enforcement of environmental legislation.
  - Public awareness.

#### **Unit 7: Human Population and the Environment:**

- Population growth, variation among nations.
- Population explosion – Family Welfare Programme.
- Environment and human health.
- Human Rights.
- Value Education.
- HIV/AIDS.
  - Women and Child Welfare.
- Role of Information Technology in Environment and human health.
- Case Studies.

#### **Unit: 8 Field Work Visit:**

Visit to a local area to document environmental assets-river / forest/ grassland/ hill / mountain

#### **Reference:**

1. Carson, R. 2002. Silent Spring, Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. This Fissured Land: An Ecological History of India, Univ. Of California Press.
3. Gleeson, B. And Law, N. (eds.) 1999, Global Ethics and Environment, London, Routledge.

4. Glied, P.H. 1993. Water Crisis, Pacific Institute for Studies in Dev. Environment & Security, Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll, Principles of Conservation Biology. Sunderland: Sinauer Associate, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalayas dams. Science, 339:36-37
7. McCully, P. 1996. Rivers no more : the environmental effects of dams (pp.29.64). Zed books.
8. McNicill John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum, E.P., Odum, H.T. & Andrees, J. 1971. Fundamenetal of Ecology, Philadelphia Saunders.
10. Pepper, J.J., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
11. Rao, M.N. & Datta, A.K 1987. Waste Water Treatment, Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012 Environment. 8th edition. John Willey & sons.
13. Rosencranz, A., Divan, S. & Noble, M.L. 2001. Environmental law and policy in India, Tirupathi 1992.
14. Sengupta, R. 2003. Ecology and Economics: An approach to sustainable development. OUP
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology E nvironmental Science and Conservation, S.Chand Publishing . New Delhi .
16. Sodhi, N.S., Gibson, I. & Raven, P.H. (EDS). 2013. Conservation Biology : Voices from the Tropics. John Willey & Sons.
17. Thapar, V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent.
18. Waren, C.E. 1971. Biology and water Pollution Control. WB Saunders.
19. Wilson, E.O. 2006. The Creation: An appeal to save life on earth. New York: Norton.
20. World Commission on Environment and Development. 1987. Our Common Future. Oxford University Press.

## **B. Sc. CHEMISTRY SYLLABUS FOR III YEAR (V SEMESTER)**

<b>COURSE TITLE</b>	<b>:</b>	<b>INORGANIC CHEMISTRY - I</b>
<b>COURSE CODE</b>	<b>:</b>	<b>BCHES-51</b>
<b>COURSE CREDIT</b>	<b>:</b>	<b>4</b>

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### **COURSE OBJECTIVES (CO)**

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While studying the Inorganic Chemistry-I course, the student will be able to:

- CO1.** Describe the characteristics and concepts involved in solid state chemistry
  - CO2.** Interpret about the theories and concepts involved in coordination chemistry
  - CO3.** Get awareness on the characteristics and concepts involved in nuclear chemistry
  - CO4.** Determine the theories and applications of protic and aprotic solvents
  - CO5.** Explain about the characteristic features of organometallic compounds
- 

### **COURSE OUTCOMES (COC)**

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After completion of the Inorganic Chemistry-I course, the student will be able to:

- COC1.** Acquire knowledge on the characteristics and concepts involved in solid state chemistry
- COC2.** Discuss the theories and concepts involved in coordination chemistry
- COC3.** Explain about the characteristics and concepts involved in nuclear chemistry
- COC4.** Get awareness on the theories and applications of protic and aprotic solvents
- COC5.** Describe the characteristic features of organometallic compounds

### **Block I: Solid state Chemistry-I**

**Unit-1-** Structure of solids - classification of solids - amorphous and crystalline solids - Van der waals crystals - covalent crystals.

**Unit-2-** Laws of crystallography Elements of symmetry - Weiss and Miller indices - crystal systems and Bravais lattices - structure of ionic solids.

**Unit-3-** Crystal defects - Schottky and Frenkel defects - F-center.

## **Block II: Coordination Chemistry-I**

**Unit-4-** Definition, nomenclature and terms involved in coordination chemistry.

**Unit-5-** Werner's and VB coordination theory - EAN rule.

**Unit-6-** Isomerism: Examples of Geometrical and optical isomerism in square planar and octahedral coordination compounds.

## **Block III: Nuclear Chemistry - I**

**Unit-7-** Introduction to Nuclear Chemistry - composition of nucleus and nuclear forces - nuclear stability - mass defect - binding energy - packing fraction - N/P ratio.

**Unit-8-** Magic numbers - nuclear models - liquid drop - Shell and collective model - Isotopes - isobars - isotones - isomers.

**Unit-9-** Radioactive decay and modes of radioactive decay - threshold energy - cross sections.

## **Block IV: Protic and Aprotic Solvents**

**Unit-10-** Definition and examples for protic and aprotic solvents - classification of solvents - general properties of ionizing solvents.

**Unit-11-** Chemical reactions with solvents such as Water, liquid NH<sub>3</sub>, liq. N<sub>2</sub>O<sub>4</sub>, liq. H<sub>2</sub>S, and liq. HF.

## **Block V: Organometallic compounds - I**

**Unit-12-** Introduction to Organometallic compounds -16 and 18- electron rule.

**Unit-13-** Preparation, physical, chemical properties and uses organomagnesium, organo lithium and organo boron compounds.

**Unit-14-** M-M bonding and cluster compounds - synthesis and reactivity of vanadates, chromates, molybdates, tungstates, manganite and permanganate.

### **Text Books:**

1. Principles of Inorganic Chemistry by B.R. Puri, L.R. Sharma, Shobanlal Nagin Chand Co. (1990).
2. Inorganic chemistry by P.L. Soni, Sultan Chand Co. (1990).
3. Advanced Inorganic Chemistry I Sathya Prakas, G. D. Tuli, S. K. Basu, R. D. Madhan, S. Chand Publishing.

4. Wahid U. Malik, G. D. Tuli, R. D. Madhan, Selected Topics in Inorganic Chemistry S. Chand Publishing.
5. J.E. Huheey, Inorganic Chemistry, Harper and Collins, NY, IV Edition, (1993).
6. J. D. Lee, Inorganic Chemistry, Oxford University Press; Fifth edition (2008).
7. Ashuthosh Kar, Advanced Inorganic Chemistry, CBS Publications, (2010).
8. Puri, Sharma, Kalia, Principles of Inorganic Chemistry, Milestone Publishers & Distributors/ Vishal Publishing Co.; 33rd edition edition (2017).

### **Reference Books:**

1. Concepts of Inorganic Chemistry by F.A. Cotton Wiley; 6th edition (1999).
2. Inorganic Reaction Mechanism – Edberg, Academic Press, (2017).
3. Inorganic Reaction Mechanism – Basolo and Pearson, John Wiley & Sons Inc; 2nd Revised edition (1967).
4. Reaction Mechanism in Inorganic Chemistry by R. R. Jordan Oxford Univ. Press,. 2nd edition (1998).
5. Solid State Chemistry and Its Applications; 2nd Ed., John Wiley and sons, New York, (2014).

### **Web Links:**

1. <https://youtu.be/i2gSLFCx65c>
2. <https://youtu.be/bccBP8C03A0>
3. <https://youtu.be/ktXK2yPdwks>
4. <https://youtu.be/8H9HcO11tUU>
5. [https://youtu.be/1SpTbmN0\\_w](https://youtu.be/1SpTbmN0_w)
6. <https://youtu.be/NaQuq9GhkGc>
7. <https://youtu.be/T7Y17MEfu8I>
8. [https://youtu.be/1Ye\\_vWk0GN0](https://youtu.be/1Ye_vWk0GN0)
9. <https://youtu.be/R0tdsaFJ4vg>
10. <https://youtu.be/w7yVVLSQ9CU>
11. [https://youtu.be/TLy\\_lx9tub4](https://youtu.be/TLy_lx9tub4)
12. <https://youtu.be/3Eml2U863ws>
13. <https://youtu.be/3FRV31YYtL8>
14. <https://youtu.be/3PmB20gPMOo>



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## B. Sc. CHEMISTRY SYLLABUS FOR III YEAR (V SEMESTER)

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<b>COURSE TITLE</b>	<b>: ORGANIC CHEMISTRY - I</b>
<b>COURSE CODE</b>	<b>: BCHES-52</b>
<b>COURSE CREDIT</b>	<b>: 4</b>

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### COURSE OBJECTIVES (CO)

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While studying the Organic Chemistry - I course, the student will be able to:

- CO1.** Explain about the chemistry of heterocyclic compounds
- CO2.** Discuss the concepts involved in the chirality of organic molecules
- CO3.** Determine the optical activity and conformational analysis of organic molecules
- CO4.** Interpret the molecular rearrangement reactions and its types
- CO5.** Acquire knowledge about the principles and applications of IR and NMR spectroscopy.

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### COURSE OUTCOMES (COC)

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After completion of the Organic Chemistry - I course, the student will be able to:

- COC1.** Acquire knowledge on the chemistry of heterocyclic compounds
- COC2.** Explain about the concepts involved in the chirality of organic molecules
- COC3.** Describe the optical activity and conformational analysis of organic molecules
- COC4.** Gain knowledge on the molecular rearrangement reactions and its types
- COC5.** Discuss about the principles and applications of IR and NMR spectroscopy.

### **Block I: Chemistry of Heterocycles**

**Unit-1-** Chemistry of Furan, Pyrrole, Thiophene, Pyridine, Indole, Quinoline and Isoquinoline.

**Unit-2-** Fisher indole synthesis - Skraup and Bischler - Nepieralski synthesis.

## **Block II: Chirality - I**

**Unit-3-** Introduction to chirality - asymmetric molecules and molecular dissymmetry - pseudo asymmetry.

**Unit-4-** Optical rotation specific rotation - optical purity – racemization.

**Unit-5-** Representation of molecules in Saw horse, Fischer, Flying-wedge and Newman formulae and their inter translations.

## **Block III: Optical activity - I**

**Unit-6-** Introduction to optical activity - Optical activity of biphenyls, allenes and spiranes - stereo selectivity and specificity - Nomenclature of geometrical isomers - cis, trans, E-Z notation and Syn.

**Unit-7-** Conformation: conformational nomenclature - eclipsed, staggered, gauche and anti; dihedral angle, torsion angle, energy barrier of rotation.

## **Block IV: Molecular rearrangement reactions**

**Unit-8-** Introduction to molecular rearrangement reaction - inter, intra molecular rearrangements.

**Unit-9-** Rearrangement to electron deficient carbon - 1,2 shift (Wagner-Meerwein, Pinacol-Pinacolone and benzil-benzilic acid rearrangements)

**Unit-10-** Rearrangements from oxygen to ring carbon (Fries, Claisen and benzidine rearrangements).

**Unit-11-** Rearrangements to electron-deficient nitrogen (Beckmann, Lossen and Schmidt rearrangements).

## **Block V: IR and NMR Spectroscopy**

**Unit-12-** Introduction and principles of IR Spectroscopy - molecular vibrations - Finger-print region - applications of IR spectroscopy - interpretation of IR spectra in the simple molecules.

**Unit-13-** Introduction and principles of NMR Spectroscopy - spinning of proton in a magnetic field - position of signals and chemical shift - factors affecting chemical shift.

**Unit-14-** Number of peaks in the NMR spectra - equivalent and non-equivalent protons- peak area and proton counting- splitting of signals - interpretation of the NMR spectrum of simple compounds like methanol, ethanol, acetaldehyde.

### **Text Books:**

1. A text book of Organic Chemistry by ArunBhal, B. S. Bhal, and S.Chand.
2. Stereochemistry, Conformation and Mechanism by P.S. Kalsi, New Academic Science, (2020).
3. Organic Chemistry by I. L.Finar, and ELBS Longman, Volume I, 5<sup>th</sup> edition.
4. Organic Chemistry by Anupa Saha and Anup Pathak, Volume I & II, Books & Allied Ltd (2013).
5. Advanced Organic Chemistry (Organic Synthesis, Heterocycles& Biomolecules) by N. Tewari, Books & Allied Ltd (2013).
6. Reactions, Rearrangements and Reagents by S.N. Sanyal, Bharati Bhawan Publishers & Distributors; Fourth edition (2019).

### **Reference Books:**

1. Organic chemistry by P.H. Pine, McGraw-Hill Inc. US; 5th revised edition (1987).
2. Spectroscopic methods in organic chemistry by Williamms and Fleming, 5th edition (2009).
3. Stereochemistry of Organic Compounds, by Ernest L. Eliel, Samuel H. Wilen, Wiley; 1st edition (2008).
4. Organic Spectroscopy, W. Kemp, Macmillan; 2nd edition (2019).
5. NMR in Chemistry, W. Kemp, Springer, Macmillan Publishers Limited, (1986).

### **Web Links:**

1. <https://youtu.be/yc1m-qQVNEw>
2. <https://youtu.be/rlCqSVrS1Zg>
3. <https://youtu.be/rgBmFXeH1Ro>
4. [https://youtu.be/duGxp\\_XZzvw](https://youtu.be/duGxp_XZzvw)
5. <https://youtu.be/GJHSL9CwmEU>
6. <https://youtu.be/SHmoLzMY37c>
7. <https://youtu.be/xpJLSx3f6ug>
8. [https://youtu.be/fYJ05Xe\\_DVQ](https://youtu.be/fYJ05Xe_DVQ)
9. <https://youtu.be/fv9h29ZChfI>
10. <https://youtu.be/LFSJ-K-kNMk>
11. [https://youtu.be/sqKrvBOOC\\_c](https://youtu.be/sqKrvBOOC_c)
12. <https://youtu.be/XTE-SG8AjgU>
13. <https://youtu.be/RqBAW-uFHK0>
14. <https://youtu.be/pH7oOiQ0GR0>

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## **B. Sc. CHEMISTRY SYLLABUS FOR III YEAR (V SEMESTER)**

<b>COURSE TITLE</b>	<b>:</b>	<b>PHYSICAL CHEMISTRY - I</b>
<b>COURSE CODE</b>	<b>:</b>	<b>BCHES-53</b>
<b>COURSE CREDIT</b>	<b>:</b>	<b>4</b>

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### **COURSE OBJECTIVES(CO)**

While studying the Physical Chemistry-I course, the student will be able to:

- CO1.** Describe the laws and terms involved in thermodynamics
- CO2.** Explain about the characteristics of solution
- CO3.** Discuss the terms and applications of electrochemistry
- CO4.** Interpret the characteristics and applications of colloids
- CO5.** Acquire knowledge on the principles and applications of molecular spectroscopy

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### **COURSE OUTCOMES (COC)**

After completion of the Physical Chemistry-I course, the student will be able to:

- COC1.** Discuss the laws and terms involved in thermodynamics
- COC2.** Determine the characteristics of solution
- COC3.** Explain the terms and applications of electrochemistry
- COC4.** Acquire knowledge on the characteristics and applications of colloids
- COC5.** Gain knowledge on the principles and applications of molecular spectroscopy

#### **Block I: Thermodynamics - I**

**Unit-1-** Introduction to thermodynamics - intensive and extensive properties - types of systems - thermodynamic process - cyclic, reversible, irreversible, isothermal and adiabatic.

**Unit-2-** Zeroth law of thermodynamic - concept of heat and work - First law of thermodynamics.

**Unit-3-** Internal energy - enthalpy - Joule's Law - Joule - Thompson effect.

## **Block II: Solution**

**Unit-4-** Introduction to ideal and non-ideal solutions - Raoult's law, Henry's law - Nernst distribution law - thermodynamics of ideal solutions.

**Unit-5-** Colligative properties: lowering of vapour pressure, elevation of boiling point, depression of freezing point and osmotic pressure.

## **Block III: Electrochemistry-I**

**Unit-6-** Introduction to electrochemical cells - cell diagram and terminology - cell e.m.f. - electrode potential - standard e.m.f. of the cell

**Unit-7-** Nernst equation - single electrode potentials and cell e.m.f. measurement of single electrode potential.

**Unit-8-** Types of electrodes - reference electrodes - standard electrode potential - electrochemical series.

## **Block IV: Colloids**

**Unit-9-** Introduction to lyophobic and lyophilic colloids - origin of charge and stability of lyophobic and lyophobic colloids.

**Unit-10-** Coagulation and Schultz-Hardy rule - Zeta potential and Stern double layer (qualitative idea) - Tyndall effect - Self Assembly - Self Assembled Monolayers (SAM) **Unit-11-** Application of colloids.

## **Block V: Molecular Spectroscopy -I**

**Unit-12-** Introduction to molecular spectroscopy- electromagnetic radiation and different regions.

**Unit-13 -** Introduction to absorption spectroscopy - molecular spectra - types of molecular spectra.

**Unit-14-** Introduction to rotational spectra - selection rule - spectra of diatomic molecules - rigid rotator - determination of moment of inertia and bond length.

## **Text Books:**

1. Physical Chemistry by Amrita Lal De and Abhranil De, Volume I, Narosa Publishing, (2009).
2. A text book of Physical Chemistry by P.L. Soni, Dharmarke and Sultan Chand.

3. Principles of Physical Chemistry by B.R. Puri, L.R. Sharma, M.S.Phathania, and Shobanlal Nagin Chand.
4. Essentials of Physical Chemistry by B.S. Bahl and G.D. Tuli, S. Chand.
5. Physical Chemistry by P.W. Atkins OUP Oxford; 9th edition (2009).

### **Reference Books:**

1. Principles of Physical Chemistry by S.M.Maron and C.F.Brutton N.Y.: Macmillan, (1958).
2. Physical Chemistry by R.A. Alberty and John-Wiley.
3. Physical Chemistry by G. M. Barrow, McGraw-Hill Inc.US; 6th revised edition (1996).
4. Elements of Physical Chemistry by S. Glasstone, D.Lewis, Palgrave Macmillan; 2nd revised edition (1963).
5. Fundamentals of Molecular Spectroscopy by Ban Welt and Taba McGraw-Hill Inc. US; 3rd edition (1983).
6. Physical Chemistry by G.W.Castelan Addison-Wesley Publishing Company, (1983).

### **Web Links:**

1. <https://youtu.be/PXf2KTfjEg>
2. <https://youtu.be/NyOYW07-L5g>
3. <https://youtu.be/r9UjlnZhom0>
4. <https://youtu.be/gcrVBb86VMQ>
5. <https://youtu.be/c8dDLe37ONg>
6. <https://youtu.be/UzkLP8segcs>
7. <https://youtu.be/UlpZB7bbT6M>
8. <https://youtu.be/SIU1gZJAnXQ>
9. <https://youtu.be/VLZQ-X7kst0>
10. <https://youtu.be/rcdQz9Fwy-s>
11. <https://youtu.be/tkZGjdQjQws>
12. <https://youtu.be/NP83R3lk354>
13. <https://youtu.be/7jOSbtR8mTs>
14. <https://youtu.be/Xau9cP699yE>

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## **B. Sc. CHEMISTRY SYLLABUS FOR III YEAR (V SEMESTER)**

<b>COURSE TITLE</b>	<b>:</b>	<b>POLYMER CHEMISTRY</b>
<b>COURSE CODE</b>	<b>:</b>	<b>BCHES-54</b>
<b>COURSE CREDIT</b>	<b>:</b>	<b>4</b>

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### **COURSE OBJECTIVES(CO)**

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While studying the Polymer Chemistry course, the student will be able to:

- CO1.** Explain about the concepts and classifications in polymerization and polymers
- CO2.** Describe the structures and properties of polymers
- CO3.** Discuss the characterization techniques involved in polymers
- CO4.** Determine the isomerism occurs in polymer molecules
- CO5.** Interpret the industrial applications of various types of polymers

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### **COURSE OUTCOMES (COC)**

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After completion of the Polymer Chemistry course, the student will be able to:

- COC1.** Acquire knowledge on the concepts and classifications in polymerization and polymers
- COC2.** Explain the structures and properties of polymers
- COC3.** Discuss the characterization techniques involved in polymers
- COC4.** Explain the isomerism occurs in polymer molecules
- COC5.** Determine the industrial applications of various types of polymers

### **Block I: Concepts in Polymers**

79

**Unit-1-** Definition and examples to polymerization and polymers - Classification of polymerization: chain growth, step growth, electrochemical and group transfer. polymerization

- Classification of polymers: Linear, branched and cross linked polymers. **Unit-2-** Thermoplastic and thermosetting polymers - elastomers, fibers and resins.

**Unit-3-** Techniques of polymerization - emulsion, bulk, solution and suspension.

## **Block II: Structure and Properties of Polymers**

**Unit-4-** Morphology and order in crystalline polymers - configurations of polymer chains - crystal structures of polymers - strain-induced morphology- crystalline melting point,  $T_m$ . **Unit-5-** The crystalline melting point,  $T_m$  - the glass transition temperature,  $T_g$ , - relationship between  $T_m$  and  $T_g$  - Effect of molecular weight, diluents, chemical structure, chain topology, branching and crosslinking.

## **Block III: Polymer Characterization**

**Unit-6-** Average molecular weight concept - Number, weight and viscosity average molecular weights - Polydispersity and molecular weight distribution.

**Unit-7-** Measurement of molecular weights - End group, viscosity, light scattering, osmotic and ultra-centrifugation methods.

**Unit-8-** Analysis and testing of polymers - chemical analysis, spectroscopic methods, thermal Analysis, XRD and SEM.

## **Block IV: Stereoisomerism in Polymers**

**Unit-9-** Introduction to stereoisomerism in polymers - types of stereoisomerism - Monosubstituted ethylenes, Disubstituted ethylenes and substituted 1,3- Butadienes.

**Unit-10-** Stereoregular polymers: significance of stereoregularity (isotactic, syndiotactic, and atactic polypropenes), Cis- and trans-1,4-poly-1,3-dienes, Cellulose and amylose.

## **Block V: Industrial Polymers**

80

**Unit-11-** Commercial Polymers: Polyethylene, Polyvinyl chloride, Polyamides, Polyesters,



Epoxy resins and silicone polymers.

**Unit-12-** Functional polymers: High temperature, Fire retarding and electrically conducting

polymers - Natural Polymers: Application and structures of starch and cellulose.

**Unit-13-** Specialty Polymers: Bio polymers - Biodegradable polymers - Biomedical polymers - Poly electrolytes - Polymer blend.

**Unit-14-** Polymer composites -Polymer nanocomposites – PN polymers - Electroluminescent polymers.

### **Text Books:**

1. Gowariker and Viswanathan, Polymer Science, Wiley Eastern, (1986).
2. S.P.Mishra, Polymer Chemistry, Wiley Eastern Ltd., New Delhi, (1993).
3. M.S.Bhatnagar, A Textbook of Polymers, Vol I, S.Chand & Company Ltd., (2004)
4. Bill Meyer, A Text Book of Polymer Chemistry, John Wiley & Sons, Singapore, (1994).
5. Charles. E. Carraher, Introduction to Polymer Chemistry, Taylor & Francis, Inc, (2006).

### **Reference Books:**

1. P. J. Flory. Principles of Polymer Chemistry, Cornell Press.
2. G. Odian, Principles of Polymerization, McGraw Hill Book Company, New York, (1973).
3. A. Rudin, The Elements of Polymer Science and Engineering. Academic Press, New York, (1973).
4. C. E. H. Brawn, The Chemistry of High Polymers, Butter worth & Co., London, (1948).
5. G. S. Krishenbaum, Polymer Science Study Guide, Gordon Breach Science publishing, New York, (1973).
6. E. A. Coolins, J. Bares and E. W. Billmeyer, Experiments in Polymer Science, Wiley Interscience, New York, (1973).

### **Web Links:**

1. <https://youtu.be/GDexD4Ygaw>
2. <https://youtu.be/gkVaRKA2At8>
3. <https://youtu.be/-xbXntt1sZw>
4. [https://youtu.be/El\\_7SY-q9WQ](https://youtu.be/El_7SY-q9WQ)
5. <https://youtu.be/5KPmwidovs>
6. <https://youtu.be/T0rKGecWvdQ>
7. <https://youtu.be/UX7VBdmQU4w>

8. <https://youtu.be/OqHO8IBI7ak>
9. <https://youtu.be/5WAWUguAFeQ>
10. <https://youtu.be/t6Q6ybqlr1o>
11. <https://youtu.be/8jjPDZxbbe4>
12. <https://youtu.be/nSAvyQajVzE>
13. <https://youtu.be/mhIeY6m10hc>
14. <https://youtu.be/reWG4zbijw>

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**B. Sc. CHEMISTRY PRACTICAL SYLLABUS - III YEAR - V SEMESTER (Distance Mode)**

**COURSE TITLE : ORGANIC ANALYSIS AND ESTIMATION**

**COURSE CODE : BCHYP-31**

**COURSE CREDIT : 4**

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**COURSE OBJECTIVES (CO)**

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While studying the Organic analysis and estimation practical course, the student shall be able to:

**CO1.** Know about the basic terms and concepts involved in the organic analysis and organic estimation of an organic compound.

**CO2.** Understand the systematic analysis of an organic compound with one functional group using preliminary tests, detection of elements present, aromatic or aliphatic, saturated or unsaturated, type of the functional groups and confirmatory tests.

**CO3.** Gain knowledge on the estimation of an organic compound.

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**COURSE OUTCOMES (COC)**

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After completion of the Organic analysis and estimation practical course, the student will have the ability to:

**COC1.** Acquire knowledge on the basic terms and concepts involved in the organic analysis and organic estimation of an organic compound.

**COC2.** Analyze the given organic compound with one functional group using preliminary tests, detection of elements present, aromatic or aliphatic, saturated or unsaturated, type of the functional groups and confirmatory tests.

**COC3.** Estimate the given organic compound

## **1. ORGANIC ANALYSIS**

Systematic analysis of an organic compound with one functional group: preliminary tests, detection of elements present, aromatic or aliphatic, saturated or unsaturated, type of the functional groups, confirmatory tests - Acids, Aldehydes, Ketones, Nitro compounds, Amines, Monosaccharide, Phenols & Esters.

## **2. ORGNAIC ESTIMATION**

1. Estimation of Phenol
2. Estimation of Aniline

## B. Sc. CHEMISTRY SYLLABUS FOR III YEAR (VI SEMESTER)

<b>COURSE TITLE</b>	<b>: INORGANIC CHEMISTRY - II</b>
<b>COURSE CODE</b>	<b>: BCHES-61</b>
<b>COURSE CREDIT</b>	<b>: 4</b>

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### COURSE OBJECTIVES (CO)

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While studying the Inorganic Chemistry-II course, the student will be able to:

- CO1.** Discuss about the characteristics and concepts involved in solid state chemistry
- CO2.** Describe the theories and concepts involved in coordination chemistry
- CO3.** Explain about the characteristics and concepts involved in nuclear chemistry
- CO4.** Determine the theories and applications of protic and aprotic solvents
- CO5.** Discuss about the characteristic features of organometallic compounds

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### COURSE OUTCOMES (COC)

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After completion of the Inorganic Chemistry-II course, the student will be able to:

- COC1.** Express the characteristics and concepts involved in solid state chemistry
- COC2.** Acquire knowledge on the theories and concepts involved in coordination chemistry
- COC3.** Obtain knowledge on the characteristics and concepts involved in nuclear chemistry
- COC4.** Discuss the theories and applications of protic and aprotic solvents
- COC5.** Gain knowledge on the characteristics features of organometallic compounds

### Block I: Solid state Chemistry - II

**Unit-1-** Ionic bonding in solids - lattice energy - Born equation and its derivation, radius ratio Rules.

**Unit-2-** Structures of ionic crystals - Sodium chloride, Zinc blende, Wurtzite, Rutile.

**Unit-3-** Defects in solids, non-stoichiometric compounds - semiconductors – superconductors.

## **Block II: Coordination Chemistry-II**

**Unit-4-** Magnetic properties of coordination compounds and their interpretation by Pauling's valence bond theory and crystal field theory.

**Unit-5-** Chelates - Nickel carbonyl chelates - application of chelates in medicine.

## **Block III: Nuclear Chemistry-II**

**Unit-6-** Nuclear fission and fusion reactions - half-life period.

**Unit-7-** Radioactive techniques - Geiger Muller and ionization counters - natural radioactivity - artificial radioactivity.

**Unit-8-** uses of radioisotopes - hazards of radiations - nuclear energy - nuclear reactors - radioactive waste disposal.

**Unit-9-** Applications of nuclear science in agriculture, biology and medicine.

## **Block IV: Acid Base chemistry**

**Unit-10-** Acid Base chemistry: Arrhenius, Bronsted-Lowry theory - proton donor - acceptor system - theory of solvent system, Lewis-electron dot system and Usanovich concept.

**Unit-11-** Acid-base Lux Flood Equilibria: pH of strong and weak acid solutions - Buffer solutions - Henderson equations - preparation of acidic and basic buffers.

## **Block V: Organometallic compounds-II**

**Unit-12-** Metal carbonyls; structure and application - mono and poly nuclear carbonyls - bridging and terminal carbonyls.

**Unit-13-** Metal carbenes, carbynes - metallocenes- Wilkinson's and Ziegler-Natta catalysts.

### **Text Books:**

1. Principles of Inorganic Chemistry by B.R. Puri, L.R. Sharma, Shobanlal Nagin Chand Co. (1990).
2. Inorganic chemistry by P.L. Soni, Sultan Chand Co. (1990).
3. Advanced Inorganic Chemistry I Sathya Prakas, G. D. Tuli, S. K. Basu, R. D. Madhan, S. Chand Publishing
4. Wahid U. Malik, G. D. Tuli, R. D. Madhan, Selected Topics in Inorganic Chemistry S. Chand Publishing. 86
5. J.E. Huheey, Inorganic Chemistry, Harper and Collins, NY, IV Edition, (1993).

6. J. D. Lee, Inorganic Chemistry, Oxford University Press; Fifth edition (2008).
7. Ashuthosh Kar, Advanced Inorganic Chemistry, CBS Publications, (2010).
8. Puri, Sharma, Kalia, Principles of Inorganic Chemistry, Milestone Publishers & Distributors/ Vishal Publishing Co.; 33rd edition (2017).

### **Reference Books:**

1. Concepts of Inorganic Chemistry by F.A. Cotton Wiley; 6th edition (1999).
2. Inorganic Reaction Mechanism – Edberg, Academic Press, (2017).
3. Inorganic Reaction Mechanism – Basolo and Pearson, John Wiley & Sons Inc; 2nd revised edition (1967).
4. Reaction Mechanism in Inorganic Chemistry by R. R. Jordan Oxford Univ.Press, 2nd edition (1998).
5. Solid State Chemistry and Its Applications; 2nd Ed., John Wiley and sons, New York, (2014).

### **Web Links:**

1. <https://youtu.be/Y17iRhBW9kg>
2. <https://youtu.be/TxTskOEJV5U>
3. [https://youtu.be/whu\\_m-jhcHI](https://youtu.be/whu_m-jhcHI)
4. <https://youtu.be/86rNPVAtj0Y>
5. <https://youtu.be/5Gv7mbhkhmQ>
6. <https://youtu.be/tt4hMzq0MxI>
7. <https://youtu.be/dW7VNsUgx74>
8. <https://youtu.be/4xxqDE4DsEY>
9. <https://youtu.be/uvuXL55yzpw>
10. <https://youtu.be/OP6RKqSp1Xw>
11. <https://youtu.be/kBzPTEB21Po>
12. <https://youtu.be/uL1OVeVD3ps>
13. <https://youtu.be/prG1Ah8b1gE>

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## B. Sc. CHEMISTRY SYLLABUS FOR III YEAR (VI SEMESTER)

<b>COURSE TITLE</b>	<b>:</b>	<b>ORGANIC CHEMISTRY - II</b>
<b>COURSE CODE</b>	<b>:</b>	<b>BCHE-62</b>
<b>COURSE CREDIT</b>	<b>:</b>	<b>4</b>

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### COURSE OBJECTIVES (CO)

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While studying the Organic Chemistry-II course, the student will be able to:

- CO1.** Discuss about the definition and applications of retrosynthetic analysis
- CO2.** Describe the concepts involved in the chirality of organic molecules
- CO3.** Interpret the optical activity and conformational analysis of organic molecules
- CO4.** Explain about the oxidation and reduction reactions and its types
- CO5.** Describe the principles and applications of UV and Mass spectroscopy

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### COURSE OUTCOMES (COC)

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After completion of the Organic Chemistry-II course, the student will be able to:

- COC1.** Acquire knowledge on the definition and applications of retrosynthetic analysis
- COC2.** Study the concepts involved in the chirality of organic molecules
- COC3.** Describe the optical activity and conformational analysis of organic molecules
- COC4.** Explain about the oxidation, reduction and condensation reactions and its types
- COC5.** Discuss about the principles and applications of UV and Mass spectroscopy

### Block I: Retrosynthetic analysis

**Unit-1-** Introduction and definition to retro synthetic analysis - disconnection - synthons - synthetic equivalents (SE).

**Unit-2-** Functional group interconversion (FGI) - Linear, Convergent and Combinatorial syntheses - Target molecule (TM) - Applications.



## **Block II: Chirality - II**

**Unit-3-** Optical isomers - enantiomers - diastereomers - epimers.

**Unit-4-** Notation of optical isomers - Cahn-Ingold-Prelog rules - R and S notations for optical isomers with one and two asymmetric carbon atoms.

**Unit-5-** Erythro, Threo, D and L representations.

## **Block III: Optical activity - II**

**Unit-6-** Potential energy diagram- relative stability of conformers on the basis of steric effect, dipole-dipole interaction and H-bonding.

**Unit-7-** Conformational analysis of ethane, propane, n-butane, 1,2-dihaloethane, 1,2-glycol, cyclopentane and cyclohexane.

## **Block IV: Oxidation, Reduction and Condensation reactions**

**Unit-8-** Introduction and definition to oxidation and reduction reactions.

**Unit-9-** MPV, Birch, Clemmensen and Wolf Kishner reductions.

**Unit-10-** Introduction and definition examples to condensation reactions - Aldol, Perkin, and Knoevenagel condensations.

## **Block V: UV and Mass Spectroscopy**

**Unit-11-** Introduction and principles of UV Spectroscopy - origin of electronic spectra-Laws of absorbance - effect of conjugation - Woodward-Fieser rules.

**Unit-12-** Applications of UV spectroscopy to simple molecules.

**Unit-13-** Introduction and principles of Mass spectroscopy

**Unit-14-** Applications of UV spectroscopy to simple molecules.

### **Text Books:**

1. A text book of Organic Chemistry by Arun Bhal, B. S. Bhal, and S.Chand.
2. Stereochemistry, Conformation and Mechanism by P.S. Kalsi, New Academic Science, (2020).
3. Organic Chemistry by I. L.Finar, and ELBS Longman, Volume I, 5<sup>th</sup> edition.
4. Organic Chemistry by Anupa Saha and Anup Pathak, Volume I & II, Books & Allied Ltd (2013).
5. Advanced Organic Chemistry (Organic Synthesis, Heterocycles & Biomolecules) by N. Tewari, Books & Allied Ltd (2013).
6. Reactions, Rearrangements and Reagents by S.N. Sanyal, Bharati Bhawan Publishers Distributors; Fourth edition (2019).

## **Reference Books:**

1. Organic chemistry by P.H. Pine, McGraw-Hill Inc. US; 5th revised edition (1987).
2. Spectroscopic methods in organic chemistry by Williamms and Fleming, 5th edition. Springer (2009).
3. Stereochemistry of Organic Compounds, by Ernest L. Eliel, Samuel H. Wilen, Wiley; 1st edition (2008).
4. Organic Spectroscopy, W. Kemp, MACMILLAN; 2nd edition, (2019).
5. NMR in Chemistry, W. Kemp, Springer, Macmillan Publishers Limited, (1986).

## **Web Links:**

1. <https://youtu.be/AVPnfEYhhiI>
2. <https://youtu.be/NwWJYCoEJHw>
3. <https://youtu.be/sxNsgedXrow>
4. <https://youtu.be/8rpkERrJnEA>
5. <https://youtu.be/cEeDqqBRrbQ>
6. <https://youtu.be/3QjH9sSa-fQ>
7. [https://youtu.be/DxgJB7\\_FkTk](https://youtu.be/DxgJB7_FkTk)
8. <https://youtu.be/5rtJdjas-mY>
9. <https://youtu.be/yJsOrKly3XQ>
10. <https://youtu.be/OBT3otCRBxg>
11. <https://youtu.be/7jOSbtR8mTs>
12. <https://youtu.be/6Mnzil9anOs>
13. <https://youtu.be/VUIPYnWLSDE>
14. <https://youtu.be/6Mnzil9anOs>

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## **B. Sc. CHEMISTRY SYLLABUS FOR III YEAR (VI SEMESTER)**

<b>COURSE TITLE</b>	<b>:</b>	<b>PHYSICAL CHEMISTRY - II</b>
<b>COURSE CODE</b>	<b>:</b>	<b>BCHES-63</b>
<b>COURSE CREDIT</b>	<b>:</b>	<b>4</b>

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### **COURSE OBJECTIVES (CO)**

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While studying the Physical Chemistry-II course, the student will be able to:

- CO1.** Explain about the laws and terms involved in thermodynamics
- CO2.** Describe the basics and terms of Group theory
- CO3.** Determine the terms and applications of electrochemistry
- CO4.** Interpret the characteristics and applications of colloids and nanomaterials
- CO5.** Discuss about the principles and applications of molecular spectroscopy

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### **COURSE OUTCOMES (COC)**

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After completion of the Physical Chemistry-II course, the student will be able to:

- COC1.** Define the laws and terms involved in thermodynamics
- COC2.** Explain the basics and terms of Group theory
- COC3.** Gain knowledge on the terms and applications of electrochemistry
- COC4.** Describe the characteristics and applications of colloids and nanomaterials
- COC5.** Discuss about the principles and applications of molecular spectroscopy

### **Block I: Thermodynamics - II**

**Unit-1-** Second law of thermodynamics and its need.

**Unit-2-** Carnots cycle - efficiency - Carnot's theorem (statement only) - concept of entropy - entropy of an ideal gas - Gibbs free energy - Helmholtz free energy - Gibbs & Helmholtz equations.

**Unit-3-** Third Law of Thermodynamics - Nernst heat theorem - absolute entropy.

## **Block II: Group theory**

**Unit-4-** Introduction to group theory - symmetry elements - symmetry operations - point groups - identification and determination.

**Unit-5-** Comparison of molecular and crystallographic symmetry.

**Unit-6-** Group multiplication table - Matrix representation of symmetry operations.

## **Block III: Electrochemistry - II**

**Unit-7-**Types of electrochemical cells: Chemicals cells - liquid junction potential - salt bridge

**Unit-8-** Concentration cells - definition and types with examples - e.m.f. of electrolyte concentration cells.

**Unit-9-** Commercial cells - primary and secondary cells - dry cell - lead storage cell and fuel cells.

## **Block IV: Nanomaterials**

**Unit-10-** Introduction to Nano materials - Types of nanoparticles - Gold, Silver, Cobalt, Alumina and Titania nanoparticles.

**Unit-11-** Techniques to synthesize nanoparticles - physical methods - physical vapour deposition (evaporation and sputtering) - chemical methods.

## **Block V: Molecular Spectroscopy -II**

**Unit-12-** Introduction to Vibrational spectra - selection rule - Hooke's law.

**Unit-13-** Simple harmonic oscillator - vibrational energy level diagram.

**Unit-14-** Anharmonic oscillator- vibrational spectra of H<sub>2</sub>O and CO<sub>2</sub>.

## **Text Books:**

1. Physical Chemistry by Amrita Lal De and Abhranil De, Volume I, Narosa Publishing, (2009).
2. A text book of Physical Chemistry by P.L. Soni, Dharmarke and Sultan Chand.
3. Symmetry and Spectroscopy of Molecules, Veera Reddy, newage publishers; Second edition (2009).
4. Principles of Physical Chemistry by B.R. Puri, L.R. Sharma, M.S.Phathania, and Shobanlal Nagin Chand.
6. Physical Chemistry by P.W. Atkins OUP Oxford; 9 edition (2009).

## **Reference Books**

1. Principles of Physical Chemistry by S.M.Maron and C.F.Brutton N.Y. Macmillan, (1958).
2. Physical Chemistry by R.A. Alberty and John-Wiley.
3. Physical Chemistry by G. M. Barrow, McGraw-Hill Inc.,US; 6th Revised edition edition (1996).
4. Elements of Physical Chemistry by S. Glasstone, D.Lewis, Palgrave Macmillan; 2nd revised edition (1963).
5. Fundamentals of Molecular Spectroscopy by Ban Welt and Taba McGraw-Hill Inc.,US; 3rd Revised edition (1983).
6. Physical Chemistry by G.W.Castelan Addison-Wesley Publishing Company, (1983).

## **Web Links:**

1. <https://youtu.be/DWiCaDPM7Hk>
2. <https://youtu.be/BznPadIkfKM>
3. <https://youtu.be/KLQ3kJ-IzUQ>
4. <https://youtu.be/BE8yQyA9RUc>
5. <https://youtu.be/gPBxBx0LWbA>
6. <https://youtu.be/5dKkACDipyg>
7. <https://youtu.be/1futudpHHVs>
8. <https://youtu.be/ar3W4HBFZjg>
9. <https://youtu.be/obpyUZ6R8Yc>
10. <https://youtu.be/MlnpUe8b5e4>
11. <https://youtu.be/m8SmeYJkHg8>
12. <https://youtu.be/BGQKjmgRjQs>
13. <https://youtu.be/g6r9bsAOOho>
14. <https://youtu.be/PXPZgjt24PA>

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## **B. Sc. CHEMISTRY SYLLABUS FOR III YEAR (VI SEMESTER)**

<b>COURSE TITLE</b>	<b>:</b>	<b>ENVIROMENTAL CHEMISTRY AND LABORATORY HYGIENE</b>
<b>COURSE CODE</b>	<b>:</b>	<b>BCHES-64</b>
<b>COURSE CREDIT</b>	<b>:</b>	<b>4</b>

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### **COURSE OBJECTIVES (CO)**

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While studying the Environmental Chemistry and Laboratory Hygiene course, the student will be able to:

**CO1.** Discuss about the air quality, sources, classification and effect of air pollution and their preventive methods.

**CO2.** Determine the water quality, sources, classification and effect of water pollution and their preventive methods

**CO3.** Describe the treatment techniques of water

**CO4.** Interpret the sources, classification and effect of radioactive pollution and their preventive methods

**CO5.** Discuss the characteristics and types of laboratory hygiene and safety rules

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### **COURSE OUTCOMES (COC)**

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After completion of the Environmental Chemistry and Laboratory Hygiene course, the student will be able to:

**COC1.** Acquire knowledge on the air quality, sources, classification and effect of air pollution and their preventive methods

**COC2.** Describe the water quality, sources, classification and effect of water pollution and their preventive methods

**COC3.** Discuss the treatment techniques of water

**COC4.** Determine the sources, classification and effect of radioactive pollution and their preventive methods

**COC5.** Interpret the characteristics and types of laboratory hygiene and safety rules

### **Block I: Air Quality and Pollution**

**Unit-1-** Bio-geo chemical cycles: Carbon, Oxygen, Nitrogen, Phosphorous and Sulphur.

**Unit-2-** Sources of air pollution - classification and effects of air pollutants: ozone depletion, acid rain, Green-house effect, climate change, global warming - control methods.

### **Block II: Water Quality and Pollution**

**Unit-3-** Water Quality parameters: colour, odour, temperature, turbidity, hardness, alkalinity, pH, conductivity, ions, SS, VOC, TDS, DO, BOD, COD, micro nutrients, heavy metals and Coli-form - Potable water and Industrial water quality.

**Unit-4-** Sources of water pollution - effect of water pollutants - control methods.

### **Block III: Water Treatment**

**Unit-5-** Pre and primary methods: aeration, filtration, sedimentation, precipitation, coagulation and flocculation, disinfection.

**Unit-6-** Secondary methods: activated sludge, trickling filters, RBC, anaerobic digestion, lagoons and ponds.

**Unit-7-** Tertiary/Advanced methods: activated carbon, ultrafiltration, ion-exchange, electro-dialysis and reverse osmosis.

### **Block IV: Radioactive pollution**

**Unit-8-** Sources of radioactive pollution - types and effect of radioactive pollutants.

**Unit-9-** Preventive methods for radioactive pollution.

### **Block V: Laboratory hygiene and Safety rules**

**Unit-10-** Introduction to common safety methods and rules.

**Unit-11-** Storage and handling of Carcinogenic chemicals, Poisonous chemicals, easily vaporizable chemicals and Inflammable Chemicals.

**Unit-12-** Waste disposal - Fume disposal - General precautions for avoiding lab accidents - First aid techniques.

### **Text Books:**

1. Textbook of Environmental Chemistry By Balram Pani I. K. International Pvt Ltd, (2010).
2. Environmental Chemistry, Anil K. De, New Age International, (2003).
3. Environmental Pollution Control Engineering, C. S. Rao, New Age International, (2007).
4. Textbook of Environmental Chemistry, O. D. Tyagi, M. Mehra, Anmol Publications, (1990).
5. Environmental Pollution Monitoring and Control, S. M. Khopkar, New Age International, (2007).
6. Environmental Chemical Analysis, Second Edition, S. Mitra, B.B. Kebbekus, Taylor & Francis, (2016).

### **Reference Books:**

1. A.K.De, Environmental Chemistry, New Age International, (2003).
2. R.Shangi, M.M.Srivatsava, Green Chemistry, Narosa Publishers, New Delhi, (2003).  
S.E.Harnung, M.S.Johnson, Chemistry and the Environment, Cambridge University Press, (2012).
3. M.Z.Jacobson, Air Pollution and Global Warming 2nd Edition, Cambridge University Press, (2012).
4. J.M.Bear, Environmental Chemistry in Society, CRC press, (2013).
5. P.T.Anasta, Green Chemistry: Theory & Practice, Oxford University Press, (2000).
6. A.E.Marteel-Parrish, M.A.Abraham, Green Chemistry and Engineering: A Pathway to Sustainability, Wiley, (2014).
7. V.K. Ahluwalia, Green Chemistry- Environmentally benign Reactions, Ane Books India, (2000).

### **Web Links:**

1. <https://youtu.be/bbmsjTkOyrs>
2. <https://youtu.be/I7Z34WU257U>
3. <https://youtu.be/RnEYXHBVJNI>
4. <https://youtu.be/15yXi3Bx4r4>
5. <https://youtu.be/q9NOKDXw3Y8>
6. <https://youtu.be/7vYyglQqo00>
7. <https://youtu.be/LSKHSQmwwE>
8. [https://youtu.be/uii9PS0\\_8U](https://youtu.be/uii9PS0_8U)
9. <https://youtu.be/72t5ruyTXZ4>



10. <https://youtu.be/mous5Jo0u9M>
11. <https://youtu.be/pr1uaIaEtWo>
12. <https://youtu.be/yB4gV-IzbuU>

**B. Sc. CHEMISTRY PRACTICAL SYLLABUS - III YEAR - VI SEMESTER (Distance Mode)**

**COURSE TITLE : GRAVIMETRIC ANALYSIS AND  
PHYSICAL CHEMISTRY EXPERIMENTS**  
**COURSE CODE : BCHYP - 32**  
**COURSE CREDIT : 4**

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**COURSE OBJECTIVES (CO)**

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While studying the Gravimetric analysis and Physical chemistry practical course, the student shall be able to:

**CO1.** Understand the basic terms and concepts involved in the gravimetric analysis and applications of physical chemistry experiments.

**CO2.** Know about how the compounds are analyzed using the gravimetric analysis method.

**CO3.** Get awareness on the application of physical chemistry experiments such as Ester hydrolysis, Determination of Critical Solution Temperature, Conductivity titration between an acid and a base, Determination of dissociation constant by conductometry and Determination of partition coefficient.

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**COURSE OUTCOMES (COC)**

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After completion of the Gravimetric analysis and Physical chemistry practical course, the student will have the ability to:

Acquire knowledge on the basic terms and concepts involved in the gravimetric analysis and applications of physical chemistry experiments.

**COC1.** Analyze the given compound using the gravimetric analysis method

**COC2.** Understand the applications of physical chemistry experiments such as Ester hydrolysis, Determination of Critical Solution Temperature, Conductivity titration between an acid and a base, Determination of dissociation constant by conductometry and Determination of partition coefficient.

## **GRAVIMETRIC ANALYSIS & PHYSICAL CHEMISTRY EXPERIMENTS**

### **1. GRAVIMETRIC ANALYSIS**

1. Estimation of Barium as Barium Chromate.
2. Estimation of Sulphate as Barium Sulphate.
3. Estimation of Lead as Lead Chromate.

### **2. PHYSICAL CHEMISTRY EXPERIMENTS**

1. Ester hydrolysis (Relative strength of acids)
2. Determination of Critical Solution Temperature of Phenol-Water system
3. Conductivity titration between an acid and a base (HCl vs NaOH).
4. Determination of dissociation constant of a weak acid (acetic acid) by conductometry.
5. Determination of partition coefficient of Iodine between carbon tetra chloride and Water.

**Chemistry Course for Other Departments**  
**as a Generic Elective (GE) course**

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**COURSE TITLE** : GENERAL CHEMISTRY  
**COURSE CODE** : BCHYE  
**COURSE CREDIT** : 2

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**COURSE OBJECTIVES (CO)**

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While studying the General Chemistry course, the student shall be able to:

- CO1. Know about the need, types and uses of chemical bonds
- CO2. Understand the need, types and uses of organic reactions
- CO3. Gain knowledge on the characteristics, types and applications of catalysis
- CO4. Study the definitions, types and applications of biomolecules
- CO5. Acquire knowledge on the types and effect of pollutions

**COURSE OUTCOMES (COC)**

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After completion of the General Chemistry course, the student will have the ability to:

- COC1. Understand the need, types and uses of chemical bonds
- COC2. Get awareness on the need, types and uses of organic reactions
- COC3. Know about the definitions, types and applications of catalysis
- COC4. Acquire knowledge on the characteristics, types and applications of biomolecules
- COC5. Gain knowledge on the types and effect of pollutions

**Block I: Chemical bonds**

**Unit-1-** Introduction, definition and need of chemical bond.

**Unit-2-**Types of bonds: Ionic, Covalent, Co-ordinate covalent, Metallic and Hydrogen bond with suitable illustrations.

## **Block II: Organic reactions**

**Unit-3**-Introduction, definition and example to an Organic reaction-Definition to Nucleophiles and Electrophiles with suitable illustrations.

**Unit-4**-Types of organic reactions - Addition, Elimination, Substitution, Rearrangement and Polymerization reactions with suitable illustrations.

## **Block III: Catalysis**

**Unit-5**-Introduction, definition and example to Catalysis and Catalysts- Types of catalysts - Positive, Negative, Homogeneous and Heterogeneous catalysts.

**Unit-6**-Definition and example to Autocatalysis, Enzyme catalysis and Acid/Base catalysis.

## **Block IV: Biomolecules**

**Unit-7**-Introduction and definition to Carbohydrates - Monosaccharides, Disaccharides and Polysaccharides -Introduction and definition to Vitamins - classifications - deficiency diseases caused by Vitamin A, B complex, C, D, E and K.

**Unit-8**-Definition, examples and uses of Hormones, reproductive hormones, Antimalarial, Antiseptics, Disinfectants, Antibiotics, Analgesics, Anaesthetics, Antipyretics and Anti-inflammatory.

## **Block V: Pollution**

**Unit-9**-Air pollution: definition, sources and effects of air pollutants - effects of fluorocarbons, ozone layer, acid rain and green-house effect

**Unit-10**-Water pollution: definition, sources and effects of water pollution - industrial effluents - water sewage - water pollution control - water treatment.

**Unit-11**-Radioactive pollution: sources, nuclear wastes, effect of radiation and preventive methods.

### **Text Books:**

1. Environmental Chemistry and Green Chemistry by Asim K. Das.
2. Introduction to Chromatography by V.K. Srivastava, K.K. Srivastava. Edition II.
3. Organic Chemistry by Anupa Saha and Anup Pathak, Volume I & II.
4. A text book of Organic Chemistry by Arun Bhal, B.S. Bhal, and S. Chand.
5. Textbook of Pharmaceutical Chemistry and Medicinal Chemistry R. Mukhopadhyay, S. Datta and R.K. Das.
6. A New Concise Inorganic Chemistry by J.D. Lee.
7. Text book of organic chemistry, P.L. Soni.
8. Organic chemistry of Natural Products by Gurdeep Wat, Volume I.
9. A Text book of Medical Biochemistry by S. Ramakrishnan, K.G. Prasanan and R. Rajan.
10. Fundamentals of Biochemistry by J.L. Jain.

11. A Text of Medical biochemistry by AmbikaShanmugam.
12. Principles of Physical Chemistry by Puri, Sharma and Pathania.

### **Reference Books**

1. Fundamentals of Organic Chemistry by T.W.GrahamSolomen, John Wiley & Sons; 4th edition (1994).
2. Principle of organic synthesis- R.O.C. Norman and J. M. Coxon.(ELBS).
3. Advanced organic chemistry (McGraw-Hill) J. March.
4. Inorganic Chemistry, J.E. Huheey, Harper and Collins, NY, IV Edition, (2010).
5. Concise Inorganic Chemistry, J. D. Lee,Wiley; Fifth Edition edition (2016).
6. Principles of Physical chemistry, P.W. Atkins, C.J. Clougston, Longman, (1986).
7. A.K.De, "Environmental Chemistry", New Age International, (2003).
8. R.Shangi, M.M.Srivatsava, "Green Chemistry", Narosa Publishers, New Delhi, (2003).
9. M.Z.Jacobson, Air Pollution and Global Warming 2nd Edition, Cambridge University Press, (2012).

### **Web Links:**

1. <https://youtu.be/bbmsjTkOyrs>
2. <https://youtu.be/I7Z34WU257U>
3. <https://youtu.be/RnEYXHBVJNI>
4. <https://youtu.be/15yXi3Bxyr4>
5. <https://youtu.be/q9NOKDXw3Y8>

## Curriculum Mapping of Core Courses of B.Sc. Chemistry

Sl. No		BCHES-11	BCHES-21	BCHES-31	BCHES-41	BCHES-51	BCHES-52	BCHES-53	BCHES-54	BCHES-61	BCHES-62	BCHES-63	BCHES-64
1	Fundamental understanding of the field	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	Application of basic Chemistry concepts	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	Linkages with related disciplines	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	Procedural knowledge for professional subjects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	Skills in related field of specialization	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6	Ability to use in Chemistry problem	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7	Skills in Mathematical modeling	-	-	-	-	✓	✓	✓	-	✓	✓	✓	-
8	Skills in performing analysis and interpretation of data	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9	Develop investigative Skills	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10	Skills in problem solving in Chemistry and related Discipline	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
11	Develop Technical Communication skills	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
12	Developing Analytical skills and popular communication	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
13	Developing ICT skills	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
14	Demonstrate Professional behaviour with respect to attribute like objectivity, ethical values, self reading, etc	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

## Curriculum Mapping of Elective Courses of B.Sc. Chemistry

(GE- Generic Electives /DSE- Discipline Specific Electives /SEC- Skill Enhancement/Ability Enhancement Courses)

Sl. No		BZOOSA-11	BCAS-13	BZOOSA-22	BCHES-P1	BPHYSA-11	BPHYSA-22	BCHES-P2	BCHES-51	BCHES-52	BCHES-53	BCHES-54	BCHES-P3	BCHES-61	BCHES-62	BCHES-63	BCHES-64	BCHES-P4
1	Fundamental understanding of the field	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	Application of basic Chemistry concepts	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	Linkages with related disciplines	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	Procedural knowledge for professional subjects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	Skills in related field of specialization	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6	Ability to use in Chemistry problem	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7	Skills in Mathematical modeling	-	-	✓	-	-	-	✓	✓	✓	✓	-	✓	✓	✓	✓	-	✓
8	Skills in performing analysis and interpretation of data	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9	Develop investigative Skills	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10	Skills in problem solving in Chemistry and related Discipline	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
11	Develop Technical Communication skills	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
12	Developing Analytical skills and popular communication	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
13	Developing ICT skills	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
14	Demonstrate Professional behaviour with respect to attribute like objectivity, ethical values, self reading, etc	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓