**FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)**

**BSc CHEMISTRY**

| | | | | | |
|---|---|---|---|---|---|
| Programme | B.Sc Chemistry | | | | |
| Course Title | **QUANTUM MECHANICS, SOLID STATE AND GASEOUS STATE** | | | | |
| Type of Course | **MINOR** | | | | |
| Semester | **II** | | | | |
| Academic Level | **100 - 199** | | | | |
| Course Details | Credit | Lecture per week | Tutorial per week | Practical per week | Total Hours |
| | 4 | 3 | - | 2 | 75 |
| Pre-requisites | 1. Basic idea the structure of atom<br>2. Fundamentals of states of matter<br>3. Basic knowledge in analytical principles | | | | |
| Course Summary | 1. This course aims to introduce the failures of classical theories in explaining many experiments and the emergence of quantum theory.<br>2. This course also aims to realise the theories of different states of matter and their implications.<br>3. This course also aims to develop proficiency in qualitative analysis and to familiarize physical chemistry experiments | | | | |

**Course Outcomes (CO):**

| CO | CO Statement | Cognitive Level* | Knowledge Category# | Evaluation Tools used |
|---|---|---|---|---|
| CO1 | To understand the importance and the impact of quantum revolution in science. | U | F | Instructor-created exams / Quiz /Assignment |
| CO2 | To evaluate the properties of solids | E | C | Instructor-created exams / Quiz /Assignment |
| CO3 | To analyse the behaviour of gases | An | C | Instructor-created exams / Quiz /Assignment |
| CO4 | To understand the properties of gaseous state and how it links to thermodynamic systems. | U | C | Instructor-created exams / Quiz /Assignment |
| CO5 | To perform the cation analysis on a provided mixture containing two cations. | An | P | Lab work |

| | | | | |
|---|---|---|---|---|
| CO6 | To enable the students to determine the physical properties (physical constants). | Ap | P | Lab work |

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

**Detailed Syllabus:**

| Module | Unit | Content | Hrs | Marks |
|---|---|---|---|---|
| **I** | | **Introduction to Quantum mechanics** | **15** | **32** |
| | 1 | Postulates of quantum mechanics – derivation of time-independent Schrodinger equation | 2 | |
| | 2 | Particle in one dimensional box problem- Schrodinger equation, derivation for expression of energy, quantisation of energy levels, HOMO-LUMO transition in 1,3-butadiene Particle in three dimensional box (no derivation)- Concept of degeneracy of energy levels | 3 | |
| | 3 | Harmonic oscillator model, Schrodinger equation and Energy levels (basic idea only, no derivation) | 1 | |
| | 4 | Spherical polar coordinates and Rigid rotor model (no derivation, basic idea only), Expression for energy, Spherical harmonics, Angular momentum | 2 | |
| | 5 | Quantum mechanics of Hydrogen-like atoms - Hamiltonian operator of H-like systems, The Schrodinger equation in spherical polar coordinates, separation of variables | 3 | |
| | 6 | Wave functions or atomic orbitals, radial and angular parts of atomic orbitals. Quantum numbers (n, l, m). | 2 | |
| | 7 | The Stern - Gerlach experiment and the concept of electron spin, spin quantum number. | 2 | |
| **II** | | **Solid state** | **10** | **22** |
| | 8 | Classification of solids: Amorphous, Crystalline, Lattice points, lattice energy (general idea), unit cell, seven crystal systems. | 2 | |
| | 9 | Weiss and Miller indices - Bravais lattices, Close packing in crystals, examples of simple cubic, bcc and fcc lattices, | 1 | |
| | 10 | Explanation of electrical properties using concepts of bands, Explanation of conductors, semiconductors and insulators, Super conductors | 2 | |
| | 11 | Magnetic Properties: classification - diamagnetic, paramagnetic, antiferromagnetic, ferro and ferrimagnetic, permanent and temporary magnets. | 3 | |
| | 12 | Defects in crystals – stoichiometric and non-stoichiometric defects (Basic ideas only). | 2 | |
| **III** | | **Gaseous state - I** | **10** | **22** |

| | | | | |
|---|---|---|---|---|
| | 13 | Characteristics of gases | 1 | |
| | 14 | Postulates of kinetic theory of gases | 2 | |
| | 15 | Maxwell's distribution of molecular velocities – Root mean square, average and most probable velocities. | 3 | |
| | 16 | Collision number – Mean free path – Collision diameter | 1 | |
| | 17 | Viscosity of gases, including their temperature and pressure dependence, | 1 | |
| | 18 | Relation between mean free path and coefficient of viscosity, calculation of $\sigma$ from $\eta$; variation of viscosity with temperature and pressure. | 2 | |
| **IV** | **Gaseous state -II** | | **10** | **22** |
| | 19 | Behaviour of real gases - Deviation from ideal behaviour – Compressibility factor | 3 | |
| | 20 | Causes of deviation from ideal behaviour - van der Waals equation of state (derivation not required) – Expression of van der Waals equation in virial form and calculation of Boyle temperature | 4 | |
| | 21 | PV isotherms of real gases – Continuity of states – Isotherm of van der Waals equation | 1 | |
| | 22 | Critical phenomena (basic idea only) – Critical constants and their determination (derivation not required) – Relationship between critical constants and van der Waals constants. | 2 | |
| **V** | **Practical**<br>A minimum of seven experiments must be done. Out of the seven experiments, one is to be open-ended which can be selected by the teacher | | **30** | |
| | 1 | Inorganic Qualitative Analysis (semi – micro analysis)<br>● Reactions of Cations: Study of the reactions of the following cations with a view of their identification and confirmation. $NH_4^+$, $Pb^{2+}$, $Cu^{2+,}$ $Cd^{2+}$, $Al^{3+}$, $Ni^{2+}$, $Co^{2+}$, $Mn^{2+}$ , $Zn^{2+}$, $Ba^{2+}$, $Sr^{2+}$, $Ca^{2+}$, and $Mg^{2+}$<br>● Systematic qualitative analysis of a solution containing any two cations from the above list. (Minimum 6 mixtures) | 25 | |
| | 2 | Open ended experiments– Physical chemistry experiments. (Any one experiment)<br>Suggestions<br>Determination of Physical Constants [Determination of colligative properties, Determination of viscosity of a binary liquid solution (Glycerol-water system) Refractometry experiments etc] | 5 | |

**Reference Books**


1. P. W. Atkins, J. de Paula, Atkin's Physical Chemistry, 8th Edn., Oxford University Press, 2006.

2. B. R. Puri, L. R. Sharma, M. S. Pathania, Principles of Physical Chemistry, 46th Edn., Vishal Publishing Company, New Delhi, 2013.
3. Kapoor K. L., Text Book of Physical Chemistry, McGraw Hill, 3rd Edn. 2017.
4. G. M. Barrow, Physical Chemistry, 5th Edn., Tata McGraw Hill Education, New Delhi, 2006.
5. Anthony R. West, Solid State Chemistry and its Applications, 2nd Edn., Wiley-Blackwell, 2014.
6. L. V. Azaroff, Introduction to Solids, Tata McGraw Hill Publishing Company, New Delhi, 1960.
7. J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas, Vogel's Textbook of Qualitative Chemical Analysis, 6th Edn., Pearson Education, Noida, 2013.
8. V. V. Ramanujam, Inorganic Semi Micro Qualitative Analysis, 3rd Edn., The National Publishing Company, Chennai, 1974.
9. A. Findlay, Findlay's Practical Physical Chemistry, 9th Edn., John Wiley and Sons, New York, 1972.
10. J. B. Yadav, Advanced Practical Physical Chemistry, Goel Publications, Meerut, 2008.

**Mapping of COs with PSOs and POs**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | | | 2 | | 1 | | | | | | |
| CO2 | 2 | | | | 2 | | 1 | | | | | | |
| CO3 | 2 | | | | 2 | | 1 | | | | | | |
| CO4 | 2 | | | | 2 | | 1 | | | | | | |
| CO5 | | | 2 | | 2 | | 1 | | | | 1 | | |
| CO6 | | | 2 | | 2 | | 1 | | | | 1 | | |

**Correlation Levels :**

| Level | Correlation |
|---|---|
| 0 | Nil |
| 1 | Slightly / Low |

| | |
|---|---|
| 2 | Moderate / Medium |
| 3 | Substantial / High |

**Assessment Rubrics:**

- Quiz / Discussion / Seminar
- Internal Theory / Practical exam
- Assignments / Viva
- End Semester Exam (70%)

**Mapping of COs to Assessment Rubrics**

| | Internal Theory / Practical Exam | Assignment / Viva | Practical Skill Evaluation | End Semester Examination |
|---|---|---|---|---|
| CO1 | ✓ | ✓ | | ✓ |
| CO2 | ✓ | ✓ | | ✓ |
| CO3 | ✓ | ✓ | | ✓ |
| CO4 | ✓ | ✓ | | ✓ |
| CO5 | ✓ | ✓ | ✓ | |
| CO6 | ✓ | ✓ | ✓ | |

**FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)**

**BSc CHEMISTRY**

| | | | | | |
|---|---|---|---|---|---|
| Programme | B.Sc Chemistry | | | | |
| Course Title | **LIQUID STATE, GASEOUS STATE AND ELECTROCHEMISTRY** | | | | |
| Type of Course | **MINOR** | | | | |
| Semester | **II** | | | | |
| Academic Level | **100 - 199** | | | | |
| Course Details | Credit | Lecture per week | Tutorial per week | Practical per week | Total Hours |
| | 4 | 3 | - | 2 | 75 |
| Pre-requisites | 1. Fundamentals of Gaseous and Liquid states of matter<br>2. Basic principles of Electrochemistry<br>3. Basic knowledge in analytical principles | | | | |
| Course Summary | 1. This course provides the students a thorough knowledge about gaseous and liquid states of matter and the continuity between them.<br>2. This course aims to impart an idea about electrochemistry<br>3. This course also aims to develop proficiency in qualitative analysis and to familiarize physical chemistry experiments | | | | |

**Course Outcomes (CO):**

| CO | CO Statement | Cognitive Level* | Knowledge Category# | Evaluation Tools used |
|---|---|---|---|---|
| CO1 | To apply the postulates of kinetic theory of gases. | Ap | F | Instructor-created exams / Quiz /Assignment |
| CO2 | To describe the properties of liquids. | E | C | Instructor-created exams / Quiz /Assignment |
| CO3 | To analyse the behaviour of gases and liquids | An | C | Instructor-created exams / Quiz /Assignment |
| CO4 | To illustrate the basic concepts of electrochemistry and its applications | U | C | Instructor-created exams / Quiz /Assignment |
| CO5 | To perform the cation analysis on a provided mixture containing two cations. | An | P | Lab work |

| | | | | |
|---|---|---|---|---|
| CO6 | To enable the students to determine the physical properties (physical constants). | Ap | P | Lab work |
| * - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)<br># - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M) | | | | |

**Detailed Syllabus:**

| Module | Unit | Content | Hrs (75) | Marks |
|---|---|---|---|---|
| **I** | **Liquid State** | | **15** | **34** |
| | 1 | Introduction – Definition and characteristics of liquids - Vapour pressure, surface tension and viscosity - Explanation of these properties on the basis of intermolecular attraction. | 4 | |
| | 2 | Kinds of solutions –Solubility of gases in liquids – Henry's law and its applications | 2 | |
| | 3 | Raoult's law – Ideal and non-ideal solutions – Dilute solutions. | 2 | |
| | 4 | Colligative properties – Qualitative treatment of colligative properties – Relative lowering of vapour pressure – Elevation of boiling point,– Depression in freezing point – Osmotic pressure – Reverse osmosis and its applications | 3 | |
| | 5 | – Application of colligative properties in finding molecular weights (thermodynamic derivation not needed) – Abnormal molecular mass – Van't Hoff factor | 2 | |
| | 6 | Introduction to liquid crystal phases. Types of liquid crystals: nematic, smectic, cholesteric. | 1 | |
| | 7 | Applications of liquid crystals. | 1 | |
| **II** | **Gaseous State - I** | | **10** | **20** |
| | 8 | Characteristics of gases | 1 | |
| | 9 | Postulates of kinetic theory of gases | 2 | |
| | 10 | Maxwell's distribution of molecular velocities – Root mean square, average and most probable velocities. | 3 | |
| | 11 | Collision number – Mean free path – Collision diameter | 1 | |
| | 12 | Viscosity of gases, including their temperature and pressure dependence, | 1 | |

| | | | | |
|---|---|---|---|---|
| | 13 | Relation between mean free path and coefficient of viscosity, calculation of σ from η; variation of viscosity with temperature and pressure. | 2 | |
| **III** | **Gaseous State - II** | | **10** | **22** |
| | 14 | Behaviour of real gases - Deviation from ideal behaviour – Compressibility factor | 3 | |
| | 15 | Causes of deviation from ideal behaviour - van der Waals equation of state (derivation not required) – Expression of van der Waals equation in virial form and calculation of Boyle temperature | 4 | |
| | 16 | PV isotherms of real gases – Continuity of states – Isotherm of van der Waals equation | 1 | |
| | 17 | Critical phenomena (basic idea only) – Critical constants and their determination (derivation not required) – Relationship between critical constants and van der Waals constants. | 2 | |
| **IV** | **Electrochemistry** | | **10** | **22** |
| | 18 | Specific conductance, equivalent conductance and molar conductance | 2 | |
| | 19 | Variation of conductance with dilution - Kohlrausch's law - Degree of ionization of weak electrolytes | 2 | |
| | 20 | Application of conductance measurements – Conductometric titrations. | 1 | |
| | 21 | Galvanic cells – emf of cell and electrode potentials - IUPAC sign convention – Reference electrodes – Standard Hydrogen electrode – Calomel electrode - Standard electrode potential - Nernst equation | 2 | |
| | 22 | $H_2$-$O_2$ fuel cell. Ostwald's dilution law – Buffer solutions – Buffer action [acetic acid/sodium acetate & $NH_4OH/NH_4Cl$], applications of buffers. | 3 | |
| **V** | **Practical**<br>A minimum of seven experiments must be done. Out of the seven experiments, one is to be open-ended which can be selected by the teacher | | **30** | |
| | 1 | a) Inorganic Qualitative Analysis (semi – micro analysis)<br>● Reactions of Cations: Study of the reactions of the following cations with a view of their identification and | 25 | |

| | | | | |
|---|---|---|---|---|
| | | confirmation. $NH_4^+$, $Pb^{2+}$, $Cu^{2+,}$ $Cd^{2+}$, $Al^{3+}$, $Ni^{2+}$, $Co^{2+}$, $Mn^{2+}$ , $Zn^{2+}$, $Ba^{2+}$, $Sr^{2+}$, $Ca^{2+}$, and $Mg^{2+}$<br>● Systematic qualitative analysis of a solution containing any two cations from the above list. (Minimum 6 mixtures) | | |
| | 2 | b) Open ended experiments– Physical chemistry experiments. (Any one experiment)<br>Suggestions<br>Determination of Physical Constants [Determination of colligative properties, Determination of viscosity of a binary liquid solution (Glycerol-water system)<br>Refractometry experiments etc.] | 5 | |

**Reference Books**


1. P. W. Atkins, J. de Paula, Atkin's Physical Chemistry, 8th Edn., Oxford University Press, 2006.
2. B. R. Puri, L. R. Sharma, M. S. Pathania, Principles of Physical Chemistry, 46th Edn., Vishal Publishing Company, New Delhi, 2013.
3. Kapoor K. L., Text Book of Physical Chemistry, McGraw Hill, 3rd Edn. 2017.
4. G. M. Barrow, Physical Chemistry, 5th Edn., Tata McGraw Hill Education, New Delhi, 2006.
5. S. Glasstone, Introduction to Electrochemistry, East-West Press Pvt. Ltd., New Delhi, 2007.
6. J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas, Vogel's Textbook of Qualitative Chemical Analysis, 6th Edn., Pearson Education, Noida, 2013.
7. V. V. Ramanujam, Inorganic Semi Micro Qualitative Analysis, 3rd Edn., The National Publishing Company, Chennai, 1974.
8. A. Findlay, Findlay's Practical Physical Chemistry, 9th Edn., John Wiley and Sons, New York, 1972.
9. J. B. Yadav, Advanced Practical Physical Chemistry, Goel Publications, Meerut, 2008.

**Mapping of COs with PSOs and POs**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 2 | | | | 2 | | 1 | | | | | | |
| CO 2 | 2 | | | | 2 | | 1 | | | | | | |
| CO 3 | 2 | | | | 2 | | 1 | | | | | | |
| CO 4 | 2 | | | | 2 | | 1 | | | | | | |
| CO 5 | | | 2 | | 2 | | 1 | | | | 1 | | |
| CO 6 | | | 2 | | 2 | | 1 | | | | 1 | | |

**Correlation Levels :**

| Level | Correlation |
|---|---|
| 0 | Nil |
| 1 | Slightly / Low |
| 2 | Moderate / Medium |
| 3 | Substantial / High |

**Assessment Rubrics:**

- Quiz / Discussion / Seminar
- Internal Theory / Practical exam
- Assignments / Viva
- End Semester Exam (70%)

**Mapping of COs to Assessment Rubrics**

| | Internal Theory / Practical Exam | Assignment / Viva | Practical Skill Evaluation | End Semester Examination |
|---|---|---|---|---|
| CO1 | ✓ | ✓ | | ✓ |
| CO2 | ✓ | ✓ | | ✓ |
| CO3 | ✓ | ✓ | | ✓ |
| CO4 | ✓ | ✓ | | ✓ |
| CO5 | ✓ | ✓ | ✓ | |
| CO6 | ✓ | ✓ | ✓ | |

**FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)**

**BSc CHEMISTRY**

| | | | | | |
|---|---|---|---|---|---|
| Programme | B.Sc Chemistry | | | | |
| Course Title | **STATES OF MATTER AND NUCLEAR CHEMISTRY** | | | | |
| Type of Course | **MINOR** | | | | |
| Semester | **II** | | | | |
| Academic Level | **100 - 199** | | | | |
| Course Details | Credit | Lecture per week | Tutorial per week | Practical per week | Total Hours |
| | 4 | 3 | - | 2 | 75 |
| Pre-requisites | 1. Fundamentals of Gaseous and Liquid states of matter<br>2. Basic idea about nucleons<br>3. Basic knowledge in analytical principles | | | | |
| Course Summary | 1. This course provides the students a thorough knowledge about gaseous and liquid states of matter and the continuity between them.<br>2. This course aims to introduce the applications of nuclear chemistry<br>3. This course also aims to develop proficiency in qualitative analysis and to familiarize physical chemistry experiments | | | | |

**Course Outcomes (CO):**

| CO | CO Statement | Cognitive Level* | Knowledge Category# | Evaluation Tools used |
|---|---|---|---|---|
| CO1 | To understand the fundamental concepts and the properties of gaseous state and how it relates to thermodynamic systems. | U | F | Instructor-created exams / Quiz /Assignment |
| CO2 | To understand the behaviour of ideal and non-ideal solutions | E | C | Instructor-created exams / Quiz /Assignment |
| CO3 | To analyse the properties of gases and liquids. | An | C | Instructor-created exams / Quiz /Assignment |
| CO4 | To apply the theories of different states of matter and understand their implications. | Ap | F | Instructor-created exams / Quiz /Assignment |

| | | | | |
|---|---|---|---|---|
| CO5 | To describe various processes in nuclear chemistry | U | C | Instructor-created exams / Quiz /Assignment |
| CO6 | To analyse cations from a given mixture and enable the students to determine the physical constants. | An | P | Lab work |
| * - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)<br># - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M) | | | | |

**Detailed Syllabus:**

| Module | Unit | Content | Hrs (75) | Marks |
|---|---|---|---|---|
| **I** | **Gaseous State - I** | | **10** | **22** |
| | 1 | Characteristics of gases | 1 | |
| | 2 | Postulates of kinetic theory of gases | 2 | |
| | 3 | Maxwell's distribution of molecular velocities – Root mean square, average and most probable velocities. | 3 | |
| | 4 | Collision number – Mean free path – Collision diameter | 1 | |
| | 5 | Viscosity of gases, including their temperature and pressure dependence, | 1 | |
| | 6 | Relation between mean free path and coefficient of viscosity, calculation of σ from η; variation of viscosity with temperature and pressure. | 2 | |
| **II** | **Gaseous State - II** | | **10** | **22** |
| | 7 | Behaviour of real gases - Deviation from ideal behaviour – Compressibility factor | 3 | |
| | 8 | Causes of deviation from ideal behaviour - van der Waals equation of state (derivation not required) – Expression of van der Waals equation in virial form and calculation of Boyle temperature | 4 | |
| | 9 | PV isotherms of real gases – Continuity of states – Isotherm of van der Waals equation | 1 | |
| | 10 | Critical phenomena (basic idea only) – Critical constants and their determination (derivation not required) – | 2 | |

| | | | | |
|---|---|---|---|---|
| | | Relationship between critical constants and van der Waals constants. | | |
| **III** | **Solutions and Liquid crystals** | | **15** | **32** |
| | 11 | Introduction – Definition and characteristics of liquids - Vapour pressure, surface tension and viscosity - Explanation of these properties on the basis of intermolecular attraction. | 4 | |
| | 12 | Kinds of solutions –Solubility of gases in liquids – Henry's law and its applications | 2 | |
| | 13 | Raoult's law – Ideal and non-ideal solutions – Dilute solutions. | 2 | |
| | 14 | Colligative properties – Qualitative treatment of colligative properties – Relative lowering of vapor pressure – Elevation of boiling point,– Depression in freezing point – Osmotic pressure – Reverse osmosis and its applications | 3 | |
| | 15 | – Application of colligative properties in finding molecular weights (thermodynamic derivation not needed) – Abnormal molecular mass – Van't Hoff factor | 2 | |
| | 16 | Introduction to liquid crystal phases. Types of liquid crystals: nematic, smectic, cholesteric. | 1 | |
| | 17 | Applications of liquid crystals. | 1 | |
| **IV** | **Nuclear Chemistry** | | **10** | **22** |
| | 18 | Natural radioactivity – Modes of decay – Group displacement law. | 2 | |
| | 19 | Nuclear forces - n/p ratio - Nuclear stability - Mass Defect - Binding energy | 2 | |
| | 10 | Isotopes, isobars and isotones with examples. Nuclear fission - Atom bomb - Nuclear fusion – Hydrogen bomb | 1 | |
| | 21 | Nuclear reactors | 1 | |
| | 22 | Application of radioactive isotopes – $^{14}C$ dating, Rock dating, Isotopes as tracers, Radio diagnosis, Radiotherapy. Problems | 4 | |
| **V** | **Practical** | | **30** | |

| | | | | |
|---|---|---|---|---|
| | A minimum of seven experiments must be done. Out of the seven experiments, one is to be open-ended which can be selected by the teacher | | | |
| | 1 | a) Inorganic Qualitative Analysis (semi – micro analysis)<br>● Reactions of Cations: Study of the reactions of the following cations with a view of their identification and confirmation. $NH_4^+$, $Pb^{2+}$, $Cu^{2+}$, $Cd^{2+}$, $Al^{3+}$, $Ni^{2+}$, $Co^{2+}$, $Mn^{2+}$ , $Zn^{2+}$, $Ba^{2+}$, $Sr^{2+}$, $Ca^{2+}$, and $Mg^{2+}$<br>● Systematic qualitative analysis of a solution containing any two cations from the above list. (Minimum 6 mixtures) | 25 | |
| | 2 | b) Open ended experiments– Physical chemistry experiments. (Any one experiment)<br>Suggestions<br>Determination of Physical Constants [Determination of colligative properties, Determination of viscosity of a binary liquid solution (Glycerol-water system)<br>Refractometry experiments etc.] | 5 | |

**Reference Books**


1. Atkins P. W. & Paula, J. de, Elements of Physical Chemistry, Oxford University Press, 6th Ed., (2006).
2. Puri, Sharma &Pathania, Principles of Physical Chemistry, Vishal Publishing Co, 47th Edn., 2017.
3. Kapoor K. L., Text Book of Physical Chemistry, McGraw Hill, 3rd Edn. 2017 G. M. Barrow, Physical Chemistry, 5th Edn., Tata McGraw Hill Education, New Delhi, 2006.
4. 1. H. J. Arnikar, Essentials of Nuclear Chemistry, 4th Edn., New Age International (P) Ltd., New Delhi, 1995
5. J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas, Vogel's Textbook of Qualitative Chemical Analysis, 6th Edn., Pearson Education, Noida, 2013.
6. V. V. Ramanujam, Inorganic Semi Micro Qualitative Analysis, 3rd Edn., The National Publishing Company, Chennai, 1974.
7. A. Findlay, Findlay's Practical Physical Chemistry, 9th Edn., John Wiley and Sons, New York, 1972.
8. J. B. Yadav, Advanced Practical Physical Chemistry, Goel Publications, Meerut, 2008.

**Mapping of COs with PSOs and POs**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 2 | | | | 2 | | 1 | | | | | | |
| CO 2 | 2 | | | | 2 | | 1 | | | | | | |
| CO 3 | 2 | | | | 2 | | 1 | | | | | | |
| CO 4 | 2 | | | | 2 | | 1 | | | | | | |
| CO 5 | 2 | | | | 2 | | 1 | | | | | | |
| CO 6 | | | 2 | | 2 | | 1 | | | | 1 | | |

**Correlation Levels :**

| Level | Correlation |
|---|---|
| 0 | Nil |
| 1 | Slightly / Low |
| 2 | Moderate / Medium |
| 3 | Substantial / High |

**Assessment Rubrics:**

- Quiz / Discussion / Seminar
- Internal Theory / Practical exam
- Assignments / Viva
- End Semester Exam (70%)

**Mapping of COs to Assessment Rubrics**

| | Internal Theory / Practical Exam | Assignment / Viva | Practical Skill Evaluation | End Semester Examination |
|---|---|---|---|---|
| CO1 | ✓ | ✓ | | ✓ |
| CO2 | ✓ | ✓ | | ✓ |
| CO3 | ✓ | ✓ | | ✓ |
| CO4 | ✓ | ✓ | | ✓ |
| CO5 | ✓ | ✓ | | ✓ |
| CO6 | ✓ | ✓ | ✓ | |

**FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)**

**BSc CHEMISTRY**

| | | | | | |
|---|---|---|---|---|---|
| Programme | B. Sc. Chemistry | | | | |
| Course Title | **CHEMISTRY IN DAILY LIFE** | | | | |
| Type of Course | **MDC** | | | | |
| Semester | **II** | | | | |
| Academic Level | **100-199** | | | | |
| Course Details | Credit | Lecture per week | Tutorial per week | Practical per week | Total Hours |
| | 3 | 3 | - | - | 45 |
| Pre-requisites | Role of chemicals in or life.<br>Basic idea of environmental pollution. | | | | |
| Course Summary | This course ensures that the students acquire a profound knowledge and understanding on chemicals that are used in daily life. | | | | |

**Course Outcomes (CO):**

| CO | CO Statement | Cognitive Level* | Knowledge Category# | Evaluation Tools used |
|---|---|---|---|---|
| CO1 | *Know the different chemicals that sustain our life* | **U** | **C** | Instructor-created exams / Quiz |
| CO2 | *Understand the role of chemistry in forensic analysis.* | U | C | Instructor-created exams / Seminar |
| CO3 | *Understand the application of chemistry in agriculture and need of green methods* | U | C | Instructor-created exams /Assignment |
| CO4 | *Understand the chemistry of soaps, synthetic detergents and their environmental effects.* | U | C | Instructor-created exams / Seminar |
| CO5 | *Understand the chemistry of cosmetics and the effect on health.* | U | C | Instructor-created exams / Quiz |

| | | | | |
|---|---|---|---|---|
| CO6 | *Understand the chemistry of drugs,food additives their action and possible side effects* | U | C | Seminar/Viva |

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

**Detailed Syllabus:**

| Module | Unit | Content | Hrs | Marks |
|---|---|---|---|---|
| **I** | **Chemistry in Biological Systems & Forensic Chemistry** | | **12** | **22** |
| | 1 | Vitamins and Minerals: Name, source, function and deficiency diseases. | 2 | |
| | 2 | Enzymes - Classifications, characteristics, examples. | 1 | |
| | 3 | Hormones - Sex hormones - example, function. Pheromones. | 2 | |
| | 4 | Brain chemicals and human mood variations | 1 | |
| | | | | |
| | 5 | General discussion of poisons with special reference to mode of action of cyanide, organophosphates and snake venom. | 2 | |
| | 6 | Detection of finger print, blood stain, semen, Breath analyzer | 2 | |
| | 7 | Sport doping-Steroids-Anabolic agents, Stimulants, Diuretics | 2 | |
| **II** | **Chemistry and Agriculture** | | **6** | **12** |
| | 8 | Essential nutrients for plants – NPK value<br>Chemical composition of soil, Soil enrichment | 1 | |
| | 9 | Fertilizers- natural, synthetic, mixed, NPK fertilizers. Excessive use of fertilizers and its impact on the environment. Bio fertilizers. | 2 | |
| | 10 | Pesticides: Classification – Insecticides, herbicides, rodenticides and fungicides (definition and examples only) – Non-degradable pesticides | 2 | |
| | 11 | Pesticide pollution and its impact on environment – Endosulfan disaster in Kerala (brief study). | 1 | |
| **III** | **Cleansing agents and cosmetics** | | **9** | **18** |
| | 12 | Soaps – Hard and soft soaps – Alkali content – TFM – Detergents (classification) – Cleaning action – Advantages and disadvantages of soaps and detergents – | 3 | |
| | 13 | Shampoos: Ingredients and functions – Different kinds of shampoos (Antidandruff, anti-lice, herbal and baby shampoos). | 1 | |
| | 14 | Tooth paste: Composition and health effects.<br>Hair dye: Chemicals used and its harmful effects. | 1 | |
| | 15 | Face and skin powders:<br>Types, ingredients and functions. Cleansing creams: Cold creams, vanishing creams and bleach creams. | 2 | |

| | | | | |
|---|---|---|---|---|
| | 16 | Perfumes, antiperspirants, sun screen preparations, nail polishes, lipsticks, rouges, eyebrow pencils and eye liners (ingredients and functions) – Harmful effects of cosmetics. | 2 | |
| **IV** | **Pharmaceuticals and Dyes** | | **9** | **18** |
| | 17 | Drug: Chemical name, generic name and trade names with examples. | 1 | |
| | 18 | Terminology: Prodrug, pharmacy, pharmacology, pharmacophore, pharmacognosy, pharmacodynamics and pharmacokinetics (elementary idea only). | 2 | |
| | 19 | Antipyretics, analgesics, antacids, antihistamines, antibiotics, antiseptics, disinfectants, anaesthetics, tranquilizers, narcotics, antidepressants and psychedelic drugs (definition and examples). | 2 | |
| | 20 | Dyes: classification based on constitution, application, examples, uses. | 2 | |
| | 21 | Dyes: Requirements of a dye – Classification based on mode of application to the fabric – | 1 | |
| | 22 | Applications of dyes (general study). Ancient and modern colours – Mention of indigo and alizarin. | 1 | |
| **V** | | **Food Chemistry (OPEN ENDED)** | **9** | |
| | 23 | Common adulterants<br>Food Additives:<br>Artificial sweeteners – Taste enhancers<br>Artificial ripening of fruits and its side effects.<br>Modern Food Habits: | | |

**References**


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**Mapping of COs with PSOs and POs :**

| | PSO 1 | PSO 2 | PSO 3 | PSO4 | PSO5 | PSO 6 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 1 | - | - | - | 1 | 1 | 1 | | | 2 | 1 | | |
| CO 2 | 1 | | - | - | 1 | 1 | 1 | | | 1 | 1 | | 1 |
| CO 3 | - | - | | 1 | 2 | 2 | 1 | | | 2 | 2 | | 1 |
| CO 4 | - | - | | | 1 | 2 | 1 | | | 1 | 1 | 1 | 1 |
| CO 5 | - | | - | 1 | 2 | 2 | 1 | | | 2 | 2 | 1 | 1 |
| CO 6 | - | - | - | 1 | 2 | 2 | 1 | | | 2 | 2 | 1 | 1 |

**Correlation Levels:**

| Level | Correlation |
|---|---|
| - | Nil |
| 1 | Slightly / Low |
| 2 | Moderate / Medium |
| 3 | Substantial / High |

**Assessment Rubrics:**

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

**Mapping of COs to Assessment Rubrics :**

| | Internal Exam | Assignment/viva | Quiz/seminar/ Goupdiscussion | End Semester Examinations |
|---|---|---|---|---|
| CO 1 | ✓ | | ✓ | ✓ |
| CO 2 | ✓ | | ✓ | ✓ |
| CO 3 | ✓ | ✓ | | ✓ |
| CO 4 | ✓ | | ✓ | ✓ |
| CO 5 | ✓ | | ✓ | ✓ |
| CO 6 | | ✓ | ✓ | |