# UNIVERSITY OF MADRAS

## B.Sc. DEGREE PROGRAMME IN PLANT BIOLOGY AND PLANT BIOTECHNOLOGY

SYLLABUS WITH EFFECT FROM 2023-2024

<table>
<tr><td>Title of the Course</td><td colspan="8">CHEMISTRY FOR BIOLOGICAL SCIENCES-I<br>(Other than Physics and Mathematics)</td></tr>
<tr><td>Paper No.</td><td colspan="8">Generic Elective</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Generic Elective</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">239E3A</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="4">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="2">-</td><td colspan="4">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher secondary chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims at providing knowledge on basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry nuclear chemistry and industrial chemistry importance of speciality drugs and separation and purification techniques.</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="8">UNIT I - Chemical Bonding and Nuclear Chemistry<br>Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M. O diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.<br>Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions- group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences.</td></tr>
<tr><td colspan="8">Unit II - Industrial Chemistry<br>Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required).<br>Silicones: Synthesis, properties and uses of silicones.<br>Fertilizers: Urea, ammonium sulphate, potassium nitrate NPK fertilizer, superphosphate, triple superphosphate.</td></tr>
<tr><td colspan="8">UNIT III - Fundamental Concepts in Organic Chemistry<br>Hybridization: Orbital overlap hybridization and geometry of $CH_4$, $C_2H_4$, $C_2H_2$ and $C_6H_6$. Polar effects: Inductive effect and consequences on Ka and $K_b$ of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation.<br>Reaction mechanisms: Types of reactions- aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation.<br>Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.</td></tr>
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<tr><td rowspan="2">Course Outline</td><td colspan="2">UNIT IV - Drugs and Speciality Chemicals<br>Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon.</td></tr>
<tr><td colspan="2">UNIT V - Analytical Chemistry<br>Introduction qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques: extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</td><td>Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="2">Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</td></tr>
<tr><td>Recommended Text</td><td colspan="2">1. A. Rajendran, Text book of Allied chemistry Vol-I & II, Dhanam publications, Chennai, First edition, 2018.<br>2. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, firstedition,2009.<br>3. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications,Karur,2006.<br>4. ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty thirdedition,2012.<br>5. P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry; SultanChand & sons, New Delhi, twentyninthedition,2007.</td></tr>
<tr><td>Reference Books</td><td colspan="2">1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company,NewDelhi,twentiethedition,2007.<br>2. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition,2014.<br>3. Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.</td></tr>
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**Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to**

**CO1:** state the theories of chemical bonding, nuclear reactions and its applications.

**CO 2:** evaluate the efficiencies and uses of various fuels and fertilizers.

**CO 3:** explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.

**CO 4:** demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.

**CO 5:** analyse various methods to identify an appropriate method for the separation of chemical components.

**CO-PO Mapping (Course Articulation Matrix)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | S | S | S | S | S | S | S | M | S | M |
| **CO2** | M | S | S | S | M | S | S | M | M | M |
| **CO3** | S | S | S | M | S | S | S | M | S | M |
| **CO4** | S | S | S | S | S | S | S | M | M | M |
| **CO5** | S | M | S | S | S | S | S | M | M | S |

**Level of Correlation between PSO's and CO's**

| CO /PO | PO1 | PO2 | PO3 | PO4 | PO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |