UNIVERSITY OF MADRAS

B.Sc. DEGREE PROGRAMME IN PHYSICS

SYLLABUS WITH EFFECT FROM 2023-2024

237E3A

<table>
<tr><td>Title of the Course</td><td colspan="7">CHEMISTRY FOR PHYSICAL SCIENCES-I
(FOR MATHEMATICS & PHYSICS STUDENTS)</td></tr>
<tr><td>Paper No.</td><td colspan="7">Generic Elective I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Generic Elective</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I/III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3"></td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher secondary chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on the
• basics of atomic orbitals, chemical bonds, hybridization
• concepts of thermodynamics and its applications.
• concepts of nuclear chemistry
• importance of chemical industries
• Qualitative and analytical methods.</td></tr>
<tr><td>rse Outline</td><td colspan="7">UNIT I
Chemical Bonding and Nuclear Chemistry

Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. 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></td><td colspan="7">Unit II
Industrial Chemistry
Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses of silicones.
Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.</td></tr>
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	UNIT III **Fundamental Concepts in Organic Chemistry** Hybridization: Orbital overlap, hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Electronic effects: Inductive effect and consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric- examples. Reaction mechanisms: Types of reactions–aromaticity (Huckel's rule) – aromatic electrophilic substitution; nitration, halogenation, Friedel- Craft's alkylation and acylation.
	UNIT IV **Thermodynamics and Phase Equilibria** Thermodynamics: Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics. Carnot's cycle and efficiency of heat engine. Entropy and its significance. Free energy change and its importance (no derivation). Conditions for spontaneity in terms of entropy and Gibbs free energy. Relationship between Gibbs free energy and entropy. Phase Equilibria**:** Phase rule - definition of terms in it. Applications of phase rule to water system. Two component system - Reduced phase rule and its application to a simple eutectic system (Pb-Ag).
	UNIT V **Analytical Chemistry** Introduction to 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.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. A. Rajendran, Text book of Allied chemistry Vol-I & II, Dhanam publications, Chennai, First edition, 2018.

	2. V. Veeraiyan, Text book of Ancillary Chemistry; High mount publishing house, Chennai, firstedition,2009. 3. S .Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications,Karur,2006. 4. S. ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition,2012. 5. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry;Sultan Chand & sons, New Delhi, twenty ninthedition, 2007.
Reference Books	5. P.L.Soni,MohanKatyal,TextbookofInorganicchemistry;SultanChandandCompany,New Delhi, twentieth edition,2007. 6. B.R.Puri,L.R.Sharma,M.S.Pathania,TextbookPhysicalChemistry;VishalPublishingCo., New Delhi, forty seventh edition,2018. 7. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, Sixteenth edition, 2014.
Course Learning Outcomes (for Mapping with POs and PSOs) **On completion of the course the students should be able to**	

CO 1: gain in-depth knowledge about 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: apply various thermodynamic principles, systems and phase rule.
CO 5: explain various methods to identify an appropriate method for the separation of chemical components

	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

CO-PO Mapping (Course Articulation Matrix)

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

Level of Correlation between PO's and CO's