**[I] Lecture Notes / Study Materials for Chemistry Honours Students (CEMA), CC-8, CBCS**

**1. ORGANIC SPECTROSCOPY**

**[A] Introduction to Spectroscopy:** Study Material-1 (PPT-1) is available here. (Contents: Introduction; electromagnetic spectrum; types of spectroscopy; absorption of electromagnetic radiation by organic molecules; laws of Photochemistry; molar extinction coefficient) [uploaded on 25. 03. 2022]

[B] **UV Spectroscopy**

(i) Study Material-2 (Part-1, PPT-2) is available here. (Contents: Introduction; nature of UV Spectrum; origin of band structure; nature of electronic excitation; transition probabilities) [uploaded on 25. 03. 2022]

(ii) Study Material-3 (Part-2, PPT-3) is available here. (Contents: Types of electronic transitions; END Absorption; spectroscopic terms (chromophores, auxochromes, bathochromic shift, hypsochromic shift, hyperchromic effect, hypochromic effect) [uploaded on 25. 03. 2022]

(iii) Study Material-4 (Part-3, PPT-4) is available here. (Contents: Rules for Calculation of $\lambda_{max}$ for the following systems; conjugated diene, *α,β-u*nsaturated aldehydes, *α,β-u*nsaturated ketones, and extended conjugated systems, (dienes, aldehydes and ketones) [uploaded on 25. 03. 2022]

(iv) Study Material-5 (Part-4, PPT-5) is available here. (Contents: Effect of conjugation on $\lambda_{max}$ $\lambda_{max}$ of non-conjugated diene; effect of steric hindrance on $\lambda_{max}$ effect of solvent polarity on $\lambda_{max}$ effective chromophore concentration: absorptions in keto-enol systems) [uploaded on 25. 03. 2022]

(v) Study Material-6 (Part-5, PPT-6) is available here. (Contents: Benzenoid transitions; substituents with unshared electrons; substituents capable of π-conjugation; electron-releasing and electron-withdrawing effects; disubstituted benzene derivatives; benzene chromophore; effect of pH on $\lambda_{max}$) [uploaded on 25. 03. 2022]

**[C] IR Spectroscopy**

(i) Study Material-7 (Part-1, PPT-7) is available here. (Contents: Introduction; modes of molecular vibrations; IR active molecules; application of Hooke's Law; force constant) [uploaded on 25. 03. 2022]

(ii) Study Material-8 (Part-2, PPT-8) is available here. (Contents: Effect of deuteration; overtone bands; vibrational coupling in IR; combination/difference bands in IR; fingerprint region; mechanics of measurement; scale of IR spectrum) [uploaded on 25. 03. 2022]

(iii) Study Material-9 (Part-3, PPT-9) is available here. (Contents: Application of IR spectroscopy; absorptions of aliphatic hydrocarbons; absorptions of olefinic hydrocarbons; absorptions of alkynic hydrocarbons and absorptions of aromatic compounds) [uploaded on 28. 03. 2022]

(iv) Study Material-10 (Part-4, PPT-10) is available here. (Contents: Absorption of alcohols and phenols; absorption of ethers; carbonyl absorptions; factors affecting carbonyl absorptions) [uploaded on 28. 03. 2022]

(v) Study Material-11 (Part-5, PPT-11) is available here. (Contents: Absorptions of ketones; absorptions of aldehydes; absorptions of carboxylic acids; absorptions of carboxylate anion; absorptions of esters; absorptions of lactones; absorptions of anhydrides) [uploaded on 03. 04. 2022]

(vi) Study Material-12 (Part-6, PPT-12) is available here. (Contents: Absorptions of amides; absorptions of lactams; absorptions of imides; absorptions of amines; absorptions of nitro compounds; absorptions of nitriles; absorptions of imines/oximes; absorptions of organic halogen compounds) [uploaded on 07. 04. 2022]

**[D] NMR Spectroscopy**

(i) Study Material-13 (Part-1, PPT-13) is available here. (Contents: Introduction; nuclear Spin; magnetic properties of nuclei; NMR active nuclei; basic principles of proton magnetic resonance; population densities of nuclear spin states) [uploaded on 10. 04. 2022]

(ii) Study Material-14 (Part-2, PPT-14) is available here. (Contents: Equivalent and nonequivalent protons; choice of solvents; choice of internal standards; chemical shifts and its units; calculation of chemical shifts) [uploaded on 12. 04. 2022]

(iii) Study Material-15 (Part-3, PPT-15) is available here. (Contents: Significance of the terms: upfield and downfield protons; significance of the terms: shielded and deshielded protons; mechanism of shielding and deshielding of protons; magnetic anisotropy; ring current effect) [uploaded on 20. 04. 2022]

(iv) Study Material-16 (Part-4, PPT-16) is available here. (Contents: Factors influencing chemical shifts; NMR peak area: Integration) [uploaded on 23. 04. 2022]

(v) Study Material-17 (Part-5, PPT-17) is available here. (Contents: Spin-spin coupling; Pascal's triangle; coupling constants) [uploaded on 06. 05. 2022]

(vi) Study Material-18 (Part-6, PPT-18) is available here. (Contents: Relative intensities of *first-Order* multiplets; chemical and magnetic equivalence in NMR; accidental equivalence in NMR; relative peak positions of common organic compounds; $^1$H NMR absorptions of ethyl bromide; $^1$H NMR absorptions of ethyl alcohol; proton exchange in alcohols) [uploaded on 06. 05. 2022]

(vii) Study Material-19 (Part-7, PPT-19) is available here. (Contents: Interpretation of NMR spectra of common organic compounds: (i) $^1$H NMR absorptions of benzene (ii) $^1$H NMR absorptions of toluene, (iii) $^1$H NMR absorptions of benzaldehyde, (iv) $^1$H NMR absorptions of nitrobenzene; spectral analysis of common organic compounds; $^1$H NMR spectroscopic problems) [uploaded on 09. 05. 2022]

**2. ASYMMETRIC SYNTHESIS**

(i) Study Material-20 (Part-1, PPT-20) is available here. (Contents: Stereoselective reactions; stereospecific reactions; principles of stereoselectivity; enantioselective synthesis; diastereoselective reaction or synthesis; nucleophilic addition to the carbonyl groups; The nucleophilic approach: Bürgi-Dunitz trajectory) [uploaded on 24. 05. 2022]

(ii) Study Material-21 (Part-2, PPT-21) is available here. (Contents: Additions of nucleophiles to aldehydes and acyclic ketones: Felkin-Anh model; The conformation of a chiral aldehyde; The effect of electronegative atoms on the chiral carbon; chelation can reverse stereoselectivity; attack on *α*-chiral carbonyl compounds: summary; problems) [uploaded on 28. 05. 2022]

**3. STRATEGY OF RING SYNTHESIS**

(i) Study Material-22 (Part-1, PPT-22) is available here. (Contents: Strategy of Ring Synthesis: Cyclisation Reactions: Intramolecular *versus* Intermolecular reactions; Thermodynamic and Kinetic factors; Difficulty in cyclisation to get large ring compounds) [uploaded on 03. 05. 2023]

(ii) Study Material-23 (Part-2, PPT-23) is available here. (Contents: Strategy of Ring Synthesis: Problems in intramolecular reactions to make large ring compounds; Ease of ring closure as a function of concentration of the reactant; High dilution principle; Synthesis of large Rings; Application of "high dilution" technique; Previous Year Questions) [uploaded on 03. 05. 2023]

**4. PREVIOUS YEARS QUESTIONS (PYQ) / MODEL QUESTIONS**

(i) PYQ on UV Spectroscopy: Questions (uploaded on 17. 03. 2023) are available here.

(ii) PYQ on IR Spectroscopy: Questions (uploaded on 22. 03. 2023) are available here.

(iii) PYQ on $^1$H-NMR Spectroscopy: Questions (uploaded on 26. 04. 2023) are available here.

(iv) PYQ on Spectral Problems: Questions (uploaded on 26. 04. 2023) are available here.

(iv) PYQ on Asymmetric Synthesis: Questions (uploaded on 25. 05. 2023) are available here.

**5. STUDENTS ASSIGNMENTS**

(i) SET-1: Assignments (uploaded on 03. 05. 2023) on UV Spectroscopy is available here.

(ii) SET-2: Assignments (uploaded on 03. 05. 2023) on IR Spectroscopy is available here.

(iii) SET-1 (MCQ): Assignments (uploaded on 24. 05. 2023) on Spectroscopy is available here.

**[II Lecture Notes / Study Materials for Chemistry Honours Students (CEMA), CBCS, CC-8P, Qualitative Organic Analysis; ORGANIC CHEMISTRY PRACTICAL**

(i) Instruction for Qualitative Organic Analysis (QOA): Study Materials (uploaded 21. 09. 2020) are available here. Contents: Detection of special element, solubility and classification, tests for nitrogenous and non-nitrogenous groups

**[III] Lecture Notes / Study Materials for Chemistry General Students (CEMG), CC-4 / GE-4, CBCS**

**1. ALCOHOLS**

(i) Study Material-1 (Part-1, PPT-1) is available here. **Contents:** Alcohols: Introduction; Nomenclature; Classification of monohydric alcohols; General methods of preparation of alcohols using Grignard reagent [uploaded on 29.04. 2021; revised on 05. 05. 2021]

(ii) Study Material-2 (Part-2, PPT-2) is available here. **Contents:** Alcohols: General methods of preparation of alcohols (i) Reduction of aldehydes and ketones; (ii) Reduction of carboxylic acids and esters; Reactions of alcohols with sodium [uploaded on 13 05. 2021]

(iii) Study Material-3 (Part-3, PPT-3) is available here. **Contents:** Alcohols: Reactions of alcohols: Oxidation of alcohols (alkaline $KMnO_4$, acidic dichromate); Pinacol-pinacolone rearrangement [uploaded on 23. 05. 2021]

2. PHENOLS AND ETHERS

(i) Study Material-1 (Part-1, PPT-4) is available here. **Contents:** Phenols: Introductions; Preparation of phenols (i) Cumene hydroperoxide mthod; (ii) From diazonium salts; Acidic nature of phenols [uploaded on 02. 06. 2021]

(ii) Study Material-2 (Part-2, PPT-5) is available here. **Contents:** Phenols: Nitration of phenols; Halogenation of phenols; Reimer-Tiemann reaction [uploaded on 11. 06. 2021]

(iii) Study Material-3 (Part-3, PPT-6) is available here. **Contents:** Phenols/Ethers: Schotten-Baumann reaction; Fries rearrangement; Claisen rearrangement; Williamson's ether synthesis; Cleavage of ethers with HI [uploaded on 27. 06. 2021]

3. CARBONYL COMPOUNDS

(i) Study Material-1 (Part-1, PPT-7) is available here. **Contents:** Carbonyl Compounds: Introduction; Nomenclature of aldehydes and ketones; Classification of carbonyl compounds; The structure of the carbonyl group [uploaded on 30. 06. 2021]

(ii) Study Material-2 (Part-2, PPT-8) is available here. **Contents:** Carbonyl Compounds: Preparation of aldehydes and ketones: Heating of calcium salt of monocarboxylic acid; Ozonolysis of suitable alkenes; Hydration of alkynes under suitable condition; Using Grignard reagents; Rosenmund's reduction; Stephen's reduction [uploaded on 30. 06. 2021]

(iii) Study Material-3 (Part-3, PPT-9) is available here. **Contents:** Carbonyl Compounds: General properties of aldehydes and ketones; Physical properties of aldehydes and ketones; Cyanohydrins of adehydes and ketones;

Formation of bisulphite compound; Reaction of nitrogen nucleophiles with carbonyl compounds: Addition/elimination reactions [uploaded on 07. 07. 2021]

(iv) Study Material-4 (Part-4, PPT-10) is available here. **Contents:** Carbonyl Compounds: Tollens' reagent test; Fehling's reagent test; Iodoform reaction; aldol condensation; Wittig reaction [uploaded on 17. 07. 2021]

(v) Study Material-5 (Part-5, PPT-11) is available here. **Contents:** Carbonyl Compounds: Cannizzaro reaction; Benzoin condensation; Clemmensen reduction; Wolff-Kishner reduction [uploaded on 17. 07. 2021]