

K.V.R GOVERNMENT COLLEGE FOR WOMEN (A), KURNOOL
M Sc. ORGANIC CHEMISTRY
III SEMESTER SYLLABUS under CBCS
EFFECTIVE FROM THE ACADEMIC YEAR 2020-2021
CHEM-301, Paper-I: ORGANIC SYNTHESIS-I

Unit-1: CONCEPTS IN ORGANIC SYNTHESIS

Introduction, Retrosynthetic analysis (disconnection approach), target molecule (TM), Synthon, synthetic equivalent (reagent), functional group inter conversion (FGI), Importance of order events; One group C-X disconnections; Chemo selectivity; two group C-X disconnections; reversal of polarity-Umpolung, cyclization, Linear & convergent synthesis.

Unit-2: CHEMISTRY OF NATURAL PRODUCTS

Structure elucidation and synthesis of **Alkaloids**-atropine, nicotine. **Terpenoids**- citral, camphor, **Steroids**-Androsterone, Progesterone.

Unit-3: CONFORMATIONAL ANALYSIS

Conformation of acyclic molecules – alkanes and substituted alkanes –compounds having intramolecular hydrogen bonding, conformations around C-C and carbon hetero atom bonds having C – O & C – N. Conformations of monocyclic compounds – cyclohexane- chair, boat and twist boat cyclohexanes, energy profile diagram –Mono and di- substituted cyclohexanes. Effect of conformation on reactivity in mono and di- substituted cyclohexane derivatives. Elementary treatment of fused and bridged ring systems – Decalines and Bornanes.

Unit-4: SYNTHETIC REACTIONS

Baylis-Hillman reaction, Grubb catalyst, Mukayama Aldol reaction, Mitsunobu reaction. McMurrey reaction, Julia-Lythgoe olefination & Peterson's stereoselective olefination. Heck reaction. Suzuki coupling, Buchwald-Hartwig coupling, Ugi reaction, Click reaction.

Books Suggested:

1. Organic synthesis by Dr.Jagdamba singh & Dr.L.D.S.Yadav.
2. Modern methods of Organic synthesis by William Carruthers & Coldham.
3. Organic reaction mechanism by V.K.Ahluwalia & R.K.Parashar.
4. Organic synthesis by C.K.Charles

K.V.R GOVERNMENT COLLEGE FOR WOMEN (A), KURNOOL
M Sc., ORGANIC CHEMISTRY
III SEMESTER SYLLABUS under CBCS
EFFECTIVE FROM THE ACADEMIC YEAR 2020-2021
CHEM-302, Paper-II: Reaction Mechanism-II & Organic Photochemistry

Unit-1: Nucleophilic substitution reaction mechanism

(a) Aliphatic Nucleophilic Substitution Mechanisms:

Neighbouring group participation. Sigma, Pi bond participation in acyclic and bicyclic systems (Non- classic carbocations)' Substitution at allylic, trigonal and Vinylic carbons.

(b) Aromatic nucleophilic substitution:

A general introduction to different mechanisms of aromatic substitution S_NAR and aryne, Von Richter rearrangement, Sommet-Hauser rearrangement and Smiles rearrangement.

Unit-2: Aliphatic Electrophilic substitution reaction mechanism

Aliphatic Electrophilic substitutions: $SE1$ $SE2$ and SEi mechanisms hydrogen exchange, migration of double bonds, halogenation of aldehydes, ketones, acids, acylhalides sulphoxides and sulphones, aliphatic diazonium coupling, nitrosation at Carbon and nitrogen diazo transfer reaction carbene and nitrene insertion, formation of sulphur yield, metalation with organometallic compounds and with metals. Decarboxylation of aliphatic acids. Haloform reaction.

Unit-3 : Organic Photo Chemistry-I

Photochemical energy plank Condon Principle, Jablonski diagram, singlet and triplet states, dissipation of photochemical energy, photosensitization, quenching, quantum efficiency and quantum yield, experimental methods of photochemistry. Photochemistry of carbonyl compounds $n-\pi$, $\pi=\pi^*$ transitions Norrish type I and Norrish type II cleavages, patterno-Buchi reaction.

Unit-4 : Organic Photo Chemistry-II

Photoreduction, photochemistry of enone, rearrangement of α , β -unsaturated ketones and cyclohexadienes, Photochemistry of p- Benzoquinones, photochemistry of unsaturated systems - Olefins, cis trans Isomerisation and dimerization, Photochemistry of 1,3 butadienes, photochemistry of aromatic compounds-1,2 and 1,4 additions of benzene, Photo Fries rearrangements, photosubstitution reactions of benzene derivatives and Barton reaction.

Books Suggested:

- 1) Advanced Organic Chemistry: Reactions Mechanisms and Structure by Jerry March, Me.Graw Hill and Kogakush.
- 2) Mechanism & Theory in Organic Chemistry, Sachin Kumar Ghosh
- 3) Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.
4. Photochemistry & Pericyclic reactions by Dr.Jagdamba singh & jaya singh.
5. Fundamentals of Photochemistry by K.K.Raotagi Mukhergi (Wiley Eastern)

K.V.R GOVERNMENT COLLEGE (A), (W): KURNOOL M.Sc.
ORGANIC CHEMISTRY
III Semester Syllabus under CBCS
(Effective from the academic year 2020-2021)
CHEM-303, Paper-III: ORGANIC SPECTROSCOPY-I

UNIT-1 UV- Visible Spectroscopy:

Mechanics of measurement – Energy transitions – Simple chromophores – Auxochrome, Absorption shifts (Bathochromic shifts, Hypsochromic shift, Hyper chromic shift, Hypo chromic shift) UV absorption of Alkenes – polyenes unsaturated cyclic systems .UV absorption of Carbonyl compounds α,β -unsaturated carbonyl systems - UV absorption aromatic systems – solvent effects – geometrical isomerism – acid and base effects – typical examples – calculation of λ_{max} values using Woodward Fieser-rules. Instrumentation.

UNIT – II IR Spectroscopy:

Mechanics of measurement – Fundamental modes of vibrations –Stretching and bending vibrations – Factors effecting vibrational frequency-hydrogen bonding Finger print region and its importance Typical group frequencies for – CH, -OH, -NH, -CC, -CO and aromatic systems - Application in structural determination – Examples – simple problems

UNIT – III Nuclear Magnetic Resonance Spectroscopy (^1H NMR – First Order PMR)

Introduction: - Basic principle of -NMR Nuclear spin- nuclear Resonance-Saturation-Relaxation- Instrumentation (CW & FT) shielding and deshielding of magnetic nuclei-chemical shift and its measurements, factors influencing chemical shift- spin – spin interactions-factors Influencing-Dynamic NMR- coupling constant J. and factors effecting J value.

UNIT – IV Mass Spectrometry:

A) Introduction- ion production-EI, CI, ES, MALDI and FAB-molecular ion peak, meta stable peak, Nitrogen rule. determination of Molecular weight and formulae- Isotopic Peaks – fragmentation of organic compounds – stability of fragments – Rearrangements –factors, affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds, common functional groups, Mc-Lafferty rearrangement. High resolution massspectrometry. Examples of mass spectral fragmentation of organic compounds with respect of their structure determination.

B) Structure determination of Organic compounds using organic spectroscopy

Books Suggested

1. Introduction to Spectroscopy – D. L. Pavia, G.M. Lampman, G. S. Kriz, 3rd Ed. (Harcourt college publishers).
2. Spectrometric identification of organic compounds R. M. Silverstein, F. X. Webster, 6thEd. John Wiley and Sons.
3. Spectroscopic methods in organic chemistry - D. H. Williams and I. Flemming McGraw Hill
4. Absorption spectroscopy of organic molecules – V. M. Parikh
5. Nuclear Magnetic Resonance – Basic Principles- Atta-Ur-Rehman, Springer-Verlag (1986).
6. One and Two dimensional NMR Spectroscopy – Atta-Ur-Rehman, Elsevier (1989).
7. Organic structure Analysis- Phillip Crews, Rodriguez, Jaspars, Oxford University Press (1998)
8. Organic Spectroscopy, W.Kemp, 5th edition (ELBS 2)
9. Spectroscopy of Organic Compounds by P.S.Kalsi
10. Elementary Organic spectroscopy by Y.R.Sharma.

**K.V.R GOVERNMENT COLLEGE (A), (W): KURNOOL M.Sc.
ORGANIC CHEMISTRY**

**III Semester Syllabus under CBCS
(Effective from the academic year 2020-2021)
CHEM-304, Paper-IV: NATURAL PRODUCTS**

Unit-1 : Heterocyclic Compounds

Synthesis and reactivity of Pyridine, quinoline, Isoquinoline, Indole, Pyrazole, Imidazole, Oxazole, Isoxazole, Thiazole, Isothiazole, pyridazine, pyrimidine and pyrazine.

Unit-2 : Proteins & Peptides

Introduction to proteins, Biological importance of proteins, characteristic of proteins. 1. Molecular weight, 2. Denaturation, 3. Iso-electric point, 4. Coagulation of proteins, 5. Salting in & out of proteins, 6. Colour reactions (Biuret test, xanthoprotein test, Millons reactions, Ninhydrin reactions).

Classification of Proteins: According to solubility On the basis of increasing complexity in to their structure. Peptides: Introduction of peptides, distinction between polypeptides & proteins, nomenclature of poly peptides, naturally occurring peptides general principles of polypeptide synthesis. Synthesis of peptides on a solid support (merrifields method)

Unit-3 : Fatty acids

Introduction, types of fatty acids (i) A saturated fatty acid (ii) unsaturated fatty acids, nomenclature of fatty acids; Isomerism in unsaturated fatty acids, Essential fatty acids. (b) Analysis of oils & fats : (i) Acid value, (ii) saponification value, (iii) iodine value, (iv) Reichert-Meissl value (c) Waxes: definition. common waxes, physiological importance of waxes

Unit-4 : Nucleic acids

Introduction of Nucleic acids, classification of nucleic acids. Isolation of nucleic acids compounds of nucleic acids, Differences between DNA & RNA, Structure of DNA, structure of RNA & conformations, replication, translation of genetic material, genetic code, gene expression, gene mutation.

Books Suggested:

1. Heterocyclic chemistry, vol 1,2&3, R.R.Gupta & M.Kumar, V.Gupta, springer verlag.
2. Heterocyclic chemistry, J.A.Joule, K.Kills & G.F.Smith (chapman & Hall)
3. Organic Chemistry of Natural Products, vol-I, Gurdeep R.Chatwal.
4. Organic chemistry of Natural Products, vol-II, I.L.Finar (ELBS)

K.V.R GOVERNMENT COLLEGE (A), (W): KURNOOL M.Sc.
ORGANIC CHEMISTRY
III Semester Syllabus under CBCS
(Effective from the academic year 2020-2021)
THIRD SEMESTER ORGANIC CHEMISTRY LAB COURSE
Under CBCS

(Total Marks 100)

Organic Mixture Analysis

Separation of two component mixture by chemical methods and their identification by chemical reactions-separation by using solvent ether, sat. aqueous sodium bicarbonate, 5% sodium hydroxide & Dil. hydrochloric acid, checking the purity of the two components by TLC, identification of the compounds by a systematic study of the physical characteristics (mp/bp), extra elements (nitrogen, halogens & sulphur), solubility, functional groups. Preparation of crystalline derivatives & identification by referring to literature. A minimum of 5 mixtures should be separated & analyzed by these procedures.

Books suggested:

1. Vogels Text book of Quantitative Chemical Analysis, Mendham, R.C.Denney, J.D.barnes & M.J.thomas, 4th & 6th Ed. (Pearson Education Asia).
2. Vogels Text book of Practical Organic Chemistry, B.S. Furniss, a.J.Hannafor, P.W.G.Smith, A.R.tatchell, 5Ed. (Longman Scientific & Technical).

K.V.R GOVERNMENT COLLEGE (A), (W): KURNOOL
M.Sc. ORGANIC CHEMISTRY
IV Semester Syllabus under CBCS
(Effective from the academic year 2020-2021)
CHEM-401, Paper-I: Organic Synthesis-II

Unit-I: Asymmetric Synthesis-I

Introduction- Topicity in molecules: Homotopic, heterotopic (enantiotopic & diastereohomotopic), Prochirality nomenclature: Pro-R, Pro-S, Re & Si-faces, stereoselective reactions, Enantioselectivity & diastereoselectivity; Chemoselectivity, Regio selectivity, Determinations of enantiomeric excess, Distereomeric excess, Asymmertric introduction.

Unit-II: Asymmetric Synthesis-II

(a) Chiral substract controlled asymmetric synthesis:

Nucleophilic additions to chiral carbonyl compounds 1,2-asymmetric induction, cram's rule & Felkin-Anh model.

(b) Chiral auxiliarycontrolled asymmetric synthesis:

α -Alkylation of chiral enolates, azaenolates, imines use of chiral auxiliaries in Diels-Alder reaction & Adol reactions.

(c) Chiral reagent controlled asymmetric synthesis:

Assymmetric reductions using BINAL-H, asymmetric hydroboration using (IPC)₂BH & IPCBH₂.

(d) Chiral catalyst controlled asymmetric synthesis:

Sharpless & Jacobsen asymmetric epoxidations; asymmetric hydrogenations using chiral Wilkinson bisphophine & Noyori catalyst; enzyme mediated enantitoselective synthesis.

Unit-III: Non-metallic reagents in Organic synthesis

Electronic structure & bonding in Boron, Phosphorus & Sulphur compounds-Their reactivity & applications in organic synthesis.

Boron Reactions:

Organoboranes in the formation of C-C bonds, alcohols, radical, amines, halogen & carbonyl compounds, free radical reactions of organoboranes; simple boranes & Hindered boranes.

(a) Phosphorus reagents:

Formation of C-C double bonds (wittig reaction, Horner-wordsworth-Emmons reactions) Functional group transformations, reactivity as electrophiles & nucleophiles.

(b) Sulphur Reagents:

Sulphur ylides; Stabilized & non-stabilized preparation & reactivity, Sulphonylcarbanions.

(c) Silicon Reagents:

Reactions involving β -carbocations & α -carbanions utility of trimethylsilyl halides, cyanides & triflates.

Unit-IV: Protecting groups in organic synthesis

Theory and importance of functional group protection and deprotection in organic synthesis: - Protecting agents for the protection of functional groups: Hydroxyl group, Amino group, Carbonyl group and Carboxylic acid group, carbon-carbon multiple bonds; chemo- and regioselective protection and deprotection; illustration of protection and deprotection in synthesis.

Books suggested:

1. Asymmetric Organic reactions, J.D.Morrisen & H.S.moscher.
2. Fundamentals of Asymmetric synthesis, G.L.David Krupadanam.
3. organic Synthesis-Special techniques, V.K.Ahluwalia & R.Aggarwal.
4. Protective groups in Organic Synthesis, 3rd edition, Theodora W.Greene, Peter G.m.wuts.

K.V.R GOVERNMENT COLLEGE (A), (W): KURNOOL M.Sc.
ORGANIC CHEMISTRY
IV Semester Syllabus under CBCS
(Effective from the academic year 2020-2021)
CHEM-402, Paper-II: Separation techniques & Green chemistry

Unit-I: Chromatography

General principles and classifications of chromatographic separations

Thin layer chromatography: Classification, principle, experimental technique, sample application, development of plate, retardation factor.

Gas liquid chromatography: Gas liquid chromatography - instrumentation (columns and detectors), retention time and retention volume. Chromatographic behaviour of solutes, column efficiency and resolution, column processes and band broadening, time of analysis and resolution, Significance of Van-Deemter equation.

High performance liquid chromatography: Theory and instrumentation column performance, gradient elution, delivery system, sample introduction, separation columns, detectors and applications of HPLC.

Unit-II: Green Chemistry-I

(A) Introduction of Green Chemistry and its fundamental principles: Principles of green Chemistry: Prevention of waste/ by-products, Hazardous Products-Designing of safer chemicals-selection of appropriate solvents and starting materials, Use of protecting groups & catalysis designing of biodegradable products.

(B) Catalysis for Green Chemistry Use of biocatalyst: Biochemical oxidation, biochemical reduction, enzyme catalyzed hydrolytic process, modified bio catalysis-transition metal catalysis-reformat sky reaction, wurtz reaction, pinacol coupling, Simmons-smith reaction, mukaiyama reaction, Heck reaction, Ullmann's coupling.

Unit-III: Green chemistry-II

(A) Solvent free reactions: Solvent free techniques-reactions on solid mineral supports, phase transfer catalysis, c-alkylation, N-alkylation, S-alkylation, Darzen's reaction. Wittig reaction.

(B) Ultra sound assisted green synthesis: Oxidation, reduction, hydroboration, Bouveault reaction, strecker reaction, microwave assisted green synthesis-Biginelli reaction, Aza-Michael reaction, Suzuki reaction, Stille reaction, sonogashira reaction.

(C) Ionic liquids: Definition-Types of ionic liquids-synthesis of ionic liquids-selection of ionic liquids-physical properties & application in organic synthesis.

Unit-IV: Chemistry of Nano Science

Basic Chemistry of Nanoscience, Chemical routes for synthesis of Nano materials; Chemical precipitation and co-precipitation, metal nano crystals by reduction, sol-gel synthesis, micro emulsions (or) reverse micelles, solvothermal synthesis, microwave heating synthesis, sonochemical synthesis.

Characterization of Nano materials: X-ray diffraction (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM).

Books suggested:

1. Fundamentals of analytical Chemistry, skoog, West, Holler.
2. Green Chemistry, A Text book, V.K.Ahluwalia
3. New trends in Green Chemistry, V.K.Ahluwalia, M.Kidwai.
4. Principles of Instrumental Analysis, D.A.Skoog, F.J.Holler, Nieman
5. Text book of Nanoscience & nanotechnology by B.S.Murthy, P.Shankar, Baldev Raj, B.B.Rath, J.Murday.

K.V.R GOVERNMENT COLLEGE (A), (W): KURNOOL M.Sc.
ORGANIC CHEMISTRY
IV Semester Syllabus under CBCS
(Effective from the academic year 2020-2021)
CHEM-403, Paper-III: ORGANIC SPECTROSCOPY-II

Unit-I: Optical rotatory dispersion (ORD) & Circular dichroism (CD)

Phenomenon of ORD & CD classification of ORD & CD curves; cotton effect curved & their application to stereo chemical problems; the octant rule & its application to alicyclic ketones.

Unit-II: ^{13}C NMR Spectroscopy

^{13}C NMR Spectroscopy CW and FT techniques. Types of ^{13}C NMR spectra: uncoupled, proton- decoupled and off-resonance decoupled (ORD) spectra. ^{13}C chemical shifts, factors affecting the chemical shifts, chemical shifts of organic compounds. Calculation of chemical shifts of alkanes, alkenes and alkynes. Homonuclear (^{13}C - ^{13}C J) and hetero nuclear (^{13}C -, ^1H J) coupling. ^{13}C -NMR spectral editing techniques: principle and applications of DEPT.

Unit-III: 2D NMR Spectroscopy

2D NMR Techniques Principles of 2D NMR, classification of 2D-experiments. Correlation spectroscopy (COSY), HOMO COSY (^1H - ^1H COSY), COSY of m-dinitrobenzene, isopentyl acetate, Hetero COSY (^1H , ^{13}C COSY) Hetero COSY of isopentyl acetate and 4-methyl-2-pentanol, HMQC, HMQC of codeine, long range ^1H , ^{13}C COSY (HMBC), HMBC of codeine and NOESY, NOESY of 9-benzylanthracene, 2-D INADEQUATE experiments.

Unit-IV: Electron spin resonance Spectroscopy (ESR)

Introduction, principle, instrumentation, selection rules, g-factor & its significance hyperfine & superhyperfine coupling, zero field splitting including Kramer's degeneracy. Applications: Detection of free radicals; ESR spectra of (a) Methyl radical, (b) Benzene anion (C_6H_6), (c) Isoquinine

Books suggested:

1. Organic spectroscopy, W.Kemp, 5th edition (ELBS)
2. Spectroscopy of Organic compounds, P.S. Kalsi
3. Spectroscopy of Organic compounds, R.M.Silverstein & Others, 5th edition (John Wiley)
4. Introduction to Spectroscopy, A guide for students of Organic Chemistry, Donald L.Pavia, Gary M.Lampman & George S.Kriz, 3rd edition (Thomson).

K.V.R GOVERNMENT COLLEGE (A), (W): KURNOOL M.Sc.
ORGANIC CHEMISTRY
IV Semester Syllabus under CBCS
(Effective from the academic year 2020-2021)
FOURTH SEMESTER CHEMISTRY LAB COURSE
Under CBCS

(Total Marks 100)

FOURTH SEMESTER LAB COURSE-PRACTICAL

Paper-I: Organic Quantitative Estimations

- i) Estimation of phenol.
- ii) Estimation of Glucose.
- iii) Estimation of Aniline.
- iv) Estimation of saponification value of an oil
- v) Estimation of acid value of a fat/oil

FOURTH SEMESTER LAB COURSE-PRACTICAL (Total Marks 100)

Paper-II: Spectral Identification of Organic Compounds

Spectral Identification of Un-Known Organic Compounds by Interpretation of UV, IR, ¹H NMR, ¹³C NMR and Mass Spectral Data

Note: A minimum of 30 representative examples should be studied.

Books Suggested:

1. A text-book of practical organic chemistry by A.I. Vogel, Vol. I & II.
2. Laboratory Manual of Organic Chemistry by B. B. Dey, M.V.Sitaraman revised by T.R.Govindachari.
3. Comprehensive Practical organic Chemistry by V.K.Ahluwalia, RenuAggarwal.

K.V.R GOVERNMENT COLLEGE (A), (W): KURNOOL M.Sc.
ORGANIC CHEMISTRY
IV Semester Syllabus under CBCS
(Effective from the academic year 2020-2021)
FOURTH SEMESTER CHEMISTRY LAB COURSE
Under CBCS

(Total Marks 100)

FOURTH SEMESTER LAB COURSE-PRACTICAL

Paper-I: Organic Quantitative Estimations

- i) Estimation of phenol.
- ii) Estimation of Glucose.
- iii) Estimation of Aniline.
- iv) Estimation of saponification value of an oil.

FOURTH SEMESTER LAB COURSE-PRACTICAL (Total Marks 100)

Paper-II: Spectral Identification of Organic Compounds

Spectral Identification of Un-Known Organic Compounds by Interpretation of UV, IR, ¹H NMR, ¹³C NMR and Mass Spectral Data

Note: A minimum of 30 representative examples should be studied.

Books Suggested:

1. A text-book of practical organic chemistry by A.I. Vogel, Vol. I & II.
2. Laboratory Manual of Organic Chemistry by B. B. Dey, M.V. Sitaraman revised by T.R. Govindachari.
3. Comprehensive Practical organic Chemistry by V.K.Ahluwalia, Renu Agarwal.