Four Year Under Graduate Programme (FYUGP)

As per provisions of NEP-2020

Vinoba Bhave University Hazaribag

Subject: **Chemistry**

To be implemented from the Academic Year **2022-23**

(From session 2022-26)

Syllabus for Semester -II

Members of Board of studies

Dr. S.K. Sahay HOD Chem. KBW College	Prof. S.K. Buxi HOD Chem. Annada College	Dr. R.K. Karn HOD Chem. Markham College of Commerce	Prof. Deepak Kumar HOD Chem. St. Columba's College	Dr. Pranita (P.G. Dept. of Chem.)	Dr. F. Rafat (P.G. Dept. of Chem.)	Dr. A.K. Saha (P.G. Dept. of Chem.)	Dr. K. Kumar (P.G. Dept. of Chem.)	Dr. S.S. Singh (P.G. Dept. of Chem.)	Dr. I. Kumar (HOD)	Dr.M. K. Srivastava HOD Dept. of Chemistry, MU Bodh Gaya (External Expert)

Semester II

MAJOR COURSE –MJ 2: (Credits: Theory-04, Practicals-02)

Marks: 15 (5 Attd. + 10 SIE: 1Hr) + 60 (ESE: 3Hrs) = 75	**Pass Marks: Th (MSE + ESE) = 30**

Instruction to Question Setter for

Semester Internal Examination (SIE 10+5=15 marks):

The Semester Internal Examination shall have two components. (a) One Semester Internal Assessment Written Test (SIA) of 15 Mark (b) Class Attendance Score (CAS) including the behaviour of the student towards teachers and other students of the College of 5 marks.

End Semester Examination (ESE 60 marks):

*There will be **two** group of questions. **Group A** will contain three questions in which all are to be answered. **Question No.1** will be **very short answer type (not MCQ)** consisting of five questions of 1 mark each. **Question No.2 & 3 will be short answer type** of 5 marks each. **Group B will contain descriptive type** five questions of fifteen marks each, out of which any three are to be answered.*

***Note:** There may be subdivisions in each question of group B.*

ORGANIC CHEMISTRY I Theory: 60 Lectures

Course Objectives:

On successful completion of this course the student should be able to understand:

1. Basic of organic molecules, structure, bonding, reactivity and reaction mechanisms.
2. Stereochemistry of organic molecules – conformation and configuration, asymmetric molecules and their nomenclature.
3. Aromatic compounds and aromaticity, mechanism of aromatic reactions.
4. Reactivity, stability of organic molecules, structure, stereochemistry.
5. Mechanism of organic reactions (effect of nucleophile/ leaving group, solvent), substitution vs. elimination.

Course Learning Outcomes:

On successful completion of this course the student should know:

1. Design and syntheses of organic molecules.
2. Predict mechanism of organic reactions.
3. Lab/ Instrumentation techniques used for analysing reaction mechanisms.

Course Content:

1. **Basics of Organic Chemistry:**
   Organic Compounds: Classification and Nomenclature, Hybridization, shape of molecules, influence of hybridization on bond properties. Electron Displacement Effects: inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications, Dipole moment, Organic acids and bases, their relative strength. Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges, Electrophiles and Nucleophiles, Nucleophilicity and basicity, Types,

shape and relative stability of reaction intermediates (Carbocations, Carbanions, Free radicals and Carbenes). Organic reactions and their mechanism: Addition, Elimination and Substitution reactions.

(10 Lectures)

2. **Stereochemistry:**
   Concept of asymmetry, Fischer Projection, Newman and Sawhorse projection formulae and their interconversions, Geometrical isomerism: cis–trans & *syn-anti* isomerism and E/Z notations with C.I.P rules. Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Diastereoisomers, Meso structures, Racemic mixtures, Resolution of racemic mixture, Relative and absolute configuration: D/L and R/S configurations.

   (12 Lectures)

3. **Chemistry of Aliphatic Hydrocarbons:**
   a. **Alkanes:** Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Corey-House synthesis, Free radical substitutions: Halogenation - relative reactivity and selectivity.

      (4 Lectures)

   b. **Alkenes & Alkynes:** Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff's and Hofmann's eliminations. Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration- demercuration, hydroboration- oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1, 2- and 1, 4- addition reactions in conjugated dienes and, Diels- Alder reaction, Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene. Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions.

      (10 Lectures)

4. **Aromatic Hydrocarbons:**
   Aromaticity: Huckel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of substituent groups.

   (8 Lectures)

5. **Polynuclear Hydrocarbons:**
   Reactions of naphthalene, phenanthrene and anthracene: Preparation, structure elucidation and important reactions.

   (6 Lectures)

6. **Chemistry of Halogenated Hydrocarbons:**
   Alkyl halides: Methods of preparation, nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent etc. Nucleophilic substitution vs. elimination. Aryl halides: Preparation from diazonium

salts. nucleophilic aromatic substitution, SNAr, Benzyne mechanism. Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions. Organometallic compounds of Mg and Li and their use in synthesis.

(10 Lectures)

Reference Books:

1. R. N. Morrison & R. N. Boyd, Organic Chemistry, 6th Edn., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. S. H. Pine, Organic Chemistry, Fifth Edition, McGraw Hill, (2007)
3. F. A. Carey, Organic Chemistry, Seventh Edition, Tata McGraw Hill (2008).
4. J. Clayden, N. Greeves, S. Warren, Organic Chemistry, 2nd Ed., (2012), Oxford University Press.
5. F. A. Carey, R. J. Sundberg, Advanced Organic Chemistry, Part A: Structure and mechanism, Kluwer Academic Publisher, (2000).
6. Undergraduate Chemistry for Semester II, Pragati Prakashan Meerut
7. P. Sykes, A guidebook to mechanism in organic chemistry, Pearson Education

CHEMISTRY PRACTICAL- MJ 2 LAB:

Marks: Pr (ESE: 3Hrs) =25 Pass Marks: Pr (ESE) = 10

Instruction to Question Setter for

End Semester Examination (ESE):

There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination may be as per the following guidelines:

Experiment	*= 15 marks*
Practical record notebook	*= 05 marks*
Viva-voce	*= 05 marks*

PRACTICALS: 60 Lectures

1. Purification of organic compounds by crystallization using the following solvents:
   a) Water
   b) Alcohol
   c) Alcohol-Water
2. Determination of the melting points of given organic compounds and unknown organic compounds (using Kjeldahl method and electrically heated melting point apparatus).
3. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds.
4. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100°C by distillation and capillary method)
5. Chromatography
   a) Separation of a mixture of two amino acids by ascending and horizontal paper chromatography
   b) Separation of a mixture of two sugars by ascending paper chromatography

Reference Books

1. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry,* Pearson Education (2009)

2. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.,*
Pearson (2012)