



Navgan Shikshan Sanstha, Rajuri(N)
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Commerce and Science College, Beed

NAAC Re-accredited 'A' Grade (3.15 CGPA) & ISO 21001-2018

M.Sc. Ist year and IInd year Organic Chemistry

Course Outcomes (COs)

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Semester : I

Course Name: Analytical Chemistry-I	Course Code: CHET/M.J/50
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Course outcomes: on completion of this course student will be able to :

1. Understand why analytical measurements need to be made.
2. Understand the importance of producing reliable results.
3. define what is meant by 'quality'.
4. understand the importance of sampling and able to identify different types of samples.
5. understand the basics in each separation techniques, viz crystallization, sublimation, distillation, extraction.
6. understand the theory of liquid-liquid extraction. understand the theory of solid-phase extraction.
7. understand basic of chromatographic Techniques for separation of constituents of mixtures understand rate and
8. plate theory of chromatography

Course Name: Inorganic Chemistry-I	Course code: CHETE/MJ/501
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Course outcomes: On completion of this course, the students will be able

1. To understand the stability constant of metal complex, stepwise and overall formation constant.
2. To describe the factors affecting for stability of metal complexes.
3. To identify and describe techniques for determination of formation constant of metal complexes.
4. To analyse the structural and stereoisomerism of metal complexes and their classifications.
5. To understand the mechanism in metal complexes.
6. To understand acid and base hydrolysis of metal complex and their mechanism.
7. To understand the role of trans effect in the synthesis of platinum complex.
8. To distinguish between the inner and outer sphere mechanism of electron transfer reaction of metal complexes.
9. To memorise the function of essential and trace elements in biological systems.
10. To describe the structure and function of metalloporphyrins, Hemoglobin, cytochrome and hemocyanine.
11. To understand the electron transfer, respiration and photosynthesis of biological system.
12. To know the diseases caused by deficiencies of Fe, Zn, Cu and Mn ions in biological system and remedies to them.

Course outcomes

Student will be able to

1. Understand the chemical and molecular processes in organic chemical reactions.
2. Study the concept of Alternant and non-alternant hydrocarbons
3. Study the energy levels of molecular orbitals
4. Explain the concept of aromaticity
5. Know the types of mechanism in organic reactions
6. Understand the correlation between the thermodynamic and kinetic parameters
7. Study the different intermediates involved in organic chemical reactions
8. Learn the various types of aliphatic nucleophilic substitution reaction

Course outcomes: student will be able

1. To understand the fundamental principles of chemical kinetics.
2. To learn different theories of chemical kinetics.
3. To understand concept of fast and slow reactions based on their rate constant and reaction rates.
4. To understand the concept of thermodynamics.
5. To apply critical thinking and problem solving skills to solve problem related to thermodynamics and chemical kinetics.
6. To understand the basic concept of micelles.

Course Name: Inorganic Chemistry Laboratory Course-1	Course Code: CHEL/MJ/-504
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Course outcomes:

On completion of this course, the students will be able:

1. To understand the difference between qualitative and quantitative analysis.
2. To understand the concept of qualitative and quantitative chemical analysis and their chemical reactions and constituents.
3. To understand the design and development of experimental setup and procedure, for volumetric and gravimetric analysis of chemical compound.
4. To identify constituents of chemicals qualitatively and quantitatively
5. To understand importance of accuracy and precision in measurement of chemical analysis
6. To apply grasped knowledge to solve chemical analysis related issues of stakeholder.
7. To understand importance of laboratory skills, precaution, accuracy and precision.
8. To separate and identify acidic & basic radicals from chemical sample.
9. To apply the grasped knowledge in chemical analysis of unknown sample.

Course Name: Organic Chemistry Laboratory Course-1	Course Code: CHEL/MJ/-505
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Learning Outcome :

On completion of this course, the students will be able

1. Understand the separation and purification techniques
2. Understand various step involved in identification of organic compounds
3. Understand the handling of equipment required for the analysis of organic compounds.
4. Understand the stichometry of the reaction
5. To check the purity of compound using TLC
6. To check the Melting point

Course Name: Physical Chemistry Laboratory Course-1	Course Code: CHEL/MJ/-506
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Course Outcomes :

On completion of this course, the students will be able:

1. To analyse sample by various instrumental techniques
2. To handling of electronic equipment
3. To understand laboratory skills, precaution, accuracy and precision.
4. To design experimental procedure for analysis important chemicals & samples
5. To understand the physical properties of chemicals
6. To distinguish accuracy of results in instrumental and non instrumental methods

Course Name: Analytical Chemistry-2	Course Code: CHETE/SE-507
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Course outcomes : after completion of course students will be able

1. to define the different regions of an electromagnetic radiation.
2. To understand the interaction/transition of the matter with different region of electromagnetic radiation.
3. to define basic elements of spectroscopic technique.
4. to calculate the wavelength at which a molecule shows maximum absorption of UV-visible radiation.
5. To interpret the ultraviolet-visible spectrum
6. to define the bands in the IR spectrum due to fundamental frequency, and overtones, combination bands and Fermi resonance
7. to define the vibrational frequency of a particular bond
8. to calculate the vibrational frequency of a particular bond
9. To interpret the infrared spectrum
10. to predict the structure using UV-visible and IR spectrum.

Course Name: Inorganic Chemistry-2	Course Code: CHETE/SE/-508
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Learning outcomes:

On completion of this course, the students will be able:

1. To understand how to perform symmetry operation to chemical molecules.
2. To identify the symmetry elements based on structure of molecules.
3. To apply the knowledge of concept of symmetry element and operations and centre, axis and planes symmetries possessed by an object / orbitals / molecule.
4. To identify & classify of point group of molecules
5. To apply knowledge of group theory to understand properties of molecules, character of matrix, product of symmetry operations, reducible and irreducible representations.
6. To use knowledge of character of representations to designate appropriate Mulliken symbols.
7. To calculate the appearance of irreducible representation by correlating relation between IRs, RRs and order of group.
8. To evaluation of predict the product of symmetric and asymmetric representations and evaluate new irreducible representation.
9. To identify modes of molecular vibrations of chemical compounds.

Course Name: Organic Chemistry-2	Course Code: CHETE/SE/-509
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Course Objectives Student will be able to

1. Understand the concept of Stereochemistry
2. Know the stereochemical notations
3. Know the difference between stereospecific and stereoselective reactions
4. Study the stereochemistry of some Chiral molecules like Biphenyls, allenes and Spiranes.
5. Acquire the knowledge of various methods of resolution
6. Understand stereochemistry of the compounds containing Nitrogen, Sulphur and phosphorous
7. Know about enantiomeric and diastereomeric excess

Course Name: Physical Chemistry-2	Course Code: CHETE/SE/-510
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Course outcomes: after completion of the course Students will be able to

1. To understand the concept of ionic equilibria, dissociation constant, buffer solution and solubility products.
2. To calculate dissociation constant, pH, pOH, pKa, pKb of acidic and basic solutions.
3. To understand the theories of electrolytes, electrocapillary phenomenon and its properties.
4. To understand the concept of surface tension of liquid and curved surfaces.

Course Name: Drug Chemistry	Course Code: CHETE/SE/-511
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Course Outcome:

Students will be able to –

1. understand about oxidation reactions in organic chemistry using different reagents.
2. know about oxidative cleavage of carbon-carbon double bonds using different reagents.
3. know about catalytic reduction, reduction using hydride ion transfer reagents and so on.
4. predict the product by the action of different oxidizing and reducing agents.

Course Name: Research methodology	Course Code: CHE/RM/-512
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Course outcomes:

On completion of this course, the students will be able to:

1. Understand the basic concepts of research methodology
2. know recent trends in chemical research.
3. Acquire the fundamental knowledge of various characterization techniques.
4. apply of characterization techniques viz.; XRD, SEM, TEM, UV, IR, NMR and Mass spectrometry in research

SEMESTER II

Course Name: Analytical Chemistry-3	Course code: CHET/MJ/- 550
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Course outcomes : after completion of the this course students will be able

1. To understand basic principle of different chromatographic Techniques for separation of constituents of mixtures
2. To understand theory, instrumentation, working procedure and application as well as limitations of TLC
3. To understand theory, instrumentation, working procedure and application as well as limitations of liquid- liquid partition chromatography
4. To understand theory, instrumentation, working procedure and application as well as limitations of column chromatography
5. To understand theory, instrumentation, working procedure and application as well as limitations of gel permeation chromatography
6. To understand theory, instrumentation, working procedure and application as well as limitations of ion exchange chromatography
7. To understand theory, instrumentation, working procedure and application as well as limitations of high performance liquid chromatography
8. To understand theory, instrumentation, working procedure and application as well as limitations of gas chromatography
9. To be able to select a particular chromatographic technique for separation of the constituents from a mixture.
10. To be aware of the various problems associated with different chromatographic techniques

Course Name: Inorganic Chemistry-3	Course Code: CHET/MJ-551
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Course outcomes:

On completion of this course, the students will be able:

1. To define and classify metal carbonyls
2. To design procedure to synthesize mononuclear and binuclear metal carbonyl
3. To understand the properties and structure metal carbonyl .
4. To apply the concept of effective atomic number for prediction of stability of metal carbonyls.
5. To synthesize the nitrosyl halides and their properties .
6. To understand the structure and properties and application of sodium nitroprusside.
7. To apply the knowledge of EAN and 18 electron rules metal nitrosyl compound of transition elements
8. To understand the d orbital splitting in different environment .
9. To understand factor affecting crystal field splitting energy
10. To describe Jahn Teller distortion and CFSE for high and low spin complexes

Course Name: Organic Chemistry-3	Course Code: CHET/MJ/-552
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Course Objectives

Student will be able to

1. Understand various reactions involved in addition to C-C and C-O double bond
2. Acquire the stereochemical aspects in addition reaction
3. Demonstrate/apply the concepts involved in elimination reaction
4. Understand mechanism of various named reactions

Course Name: Physical Chemistry-3	Course Code: CHET/MJ/553
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Course Outcomes: student will be able

1. To understand the fundamental principles of quantum mechanics.
2. To solve the Schrodinger equations calculate wave function and energy levels.
3. To understand the postulates of quantum mechanics.
4. To understand the Huckel Molecular Theory of conjugated system and its applications.

Course Name: Inorganic Chemistry Laboratory Course II	Course Code:CHEL/MJ/554
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Learning outcomes:

On completion of this course, the students will be able:

1. To design experimental procedure for synthesis of metal complexes , calculation of conversion factors and characterization of synthesized coordination complexes compounds.
2. To understand, which skills are required in chemical laboratory .
3. To understand importance of accuracy and precision in chemical analysis
4. To design the experimental procedure for separation and estimation of metals from mixture solution
5. To estimate the amount of constituents of chemicals by volumetric and gravimetric methods.
6. To apply grasped knowledge for finding purity of chemicals

Course Name: Organic Chemistry Laboratory Course II	Course Code:CHEL/MJ/555
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Course Outcomes

1. To Perform/demonstrate the techniques involved in organic binary mixture separation specially solid-liquid mixture.
2. To perform distillation techniques for purification of organic compounds.
3. To use/ apply the technique of separation, crystallization derivatization and function Group detection.
4. To use the methods for the preparation of useful compounds using named reaction

Would you like me to outline a standard laboratory procedure for

Course Name: Physical Chemistry Laboratory Course - II	Course Code: CHEL/MJ/556
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Course Outcome :

On completion of this course, the students will be able:

1. To analyse sample by various instrumental techniques
2. To handling of electronic equipment
3. To understand laboratory skills, precaution, accuracy and precision.
4. To design experimental procedure for analysis important chemicals & samples
5. To understand the physical properties of chemicals
6. To distinguish accuracy of results in instrumental and non instrumental methods

Course Name: Analytical Chemistry-4	Course Code: CHETE-557
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Course outcomes :

1. To be able to define the factors that determine chemical shift
2. To be able to locate chemical shift positions of ¹H attached to common functional groups.
3. To be able to define the characteristic chemical shifts for different protons.
4. To be able to predict the structure of a compound using NMR data/spectrum.

5. To be able to predict the structure of a compound using UV-visible, IR, and NMR data/spectrum.
6. To understand the principle, instrumentation and applications of mass spectrometry.
7. To be able to define different ionization techniques in mass spectrometry.
8. To understand the fragmentation processes in mass spectrometry.
9. To be able to define the molecular formula from molecular ion peaks.
10. To understand the principle, instrumentation and applications of atomic absorption spectroscopy, flame emission spectroscopy, electron spectroscopy for chemical analysis, Auger electron spectroscopy and ultraviolet photoelectron spectroscopy.

Course Name: Inorganic Chemistry-4	Course Code : CHETE/SE/-558
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Learning outcomes:

On completion of this course, the students will be able:

1. To describe the generation of spectroscopic term symbols , ground state term & total term symbols, significance of spin multiplicities.
2. To use of microstates for representation electron representations
3. To sketch term energy level diagram.
4. To understand the designation of spin multiplicities to ligand field excited states of high and low spin complex.
5. To interpret A,E, T symmetric label for electronic configurations.
6. To construct correlation diagram of various electronic configurations
7. To analyse and interpretation Orgel diagram and Tanabe Sugano diagram.
8. To interpret electronic spectra of transition metal complexes.
9. To calculate the Dq, B and β parameters of complex.
10. To understand the Lewis and Bronsted Concept of Acids and Bases.
11. To apply knowledge of VBT & VSEPR theory for prediction structure of molecules .

Course Name: Organic Chemistry-4	Course Code: CHETE/SE/-559
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Course Objectives

Student will be able to

1. Understand aromatic electrophilic substitution reactions
2. Acquire the knowledge of directing nature of functional groups
3. Know directing nature of attacking electrophiles on various aromatics
4. Understand requirement for aromatic nucleophilic substitution reactions
5. Describe the basic concepts in molecular rearrangement
6. Acquire the knowledge of migratory aptitude

Course Name: Physical Chemistry4	Course Code: CHETE/SE/560
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Course outcomes:

1. To understand the basic concepts of phase rule
2. To analyse and interpret phase diagrams for single and multicomponent systems.
3. To understand the basic concept of crystallography.
4. To understand the basic concepts of photochemistry, their different theories and possible applications.

Course Name: Drug Chemistry-2	Course Code: CHETE/SE/-561
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Course Outcomes:

1. To provide details about Drugs, their characterization and classification
2. To know about sources of drugs, historical development and other parameters such as Lead discovery, lead development; Pharmacological / Microbiological / Biochemical evaluation; Clinical trials; and Pharmacokinetic
3. To provide the information about dosage forms, drug toxicity and it's prevention

Course Name: Field Project	Course Code: CHFP-562
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Learning outcomes:

On completion of this course, the students will be able:

- Get experiential learning while field work

Course Outcomes (COs)

M.Sc IInd year

Sester II and III

Course name :-Structural Elucidation by Spectral Methods

Course code:- (OCHET-600)

1. Review elementary concepts of nuclear magnetic resonance spectroscopy and delve into spin-spin couplings, factors affecting coupling constants, and spin systems like AB, AX, and ABX.
2. Explore techniques such as INEPT, INADEQUATE, and the Nuclear Overhauser effect.
3. Grasp elementary concepts of ^{13}C NMR spectroscopy, including chemical shifts for various carbon types and the impact of substituents on these shifts.
4. Understand the fundamentals of mass Spectrometry, including ion production methods, ion analysis, factors affecting fragmentation, and the interpretation of mass spectra.
5. Explore fragmentation patterns for various functional groups and phenomena like the molecular ion peak and McLafferty rearrangement.
6. Grasp the principles of Mössbauer Spectroscopy, understanding factors influencing line position and shape, including the isomer effect and quadrupole splitting.

Course name :-Reagents in Organic Synthesis

Course code:- (OCHET-601)

1. Explore metal and non-metal based oxidising agents for functional group transformations.
2. Understand the selectivity in the reagents for carrying oxidations.
3. Learn the utility of the reagents.
4. Explore the suitable methods to carry out oxidation and dihydroxylation.
5. Explore the synthetic utility of various hydride transfer reagents for reduction of functional groups.
6. Understand the preparation and applications of organic reagents for different types of reactions.
7. Utilize the various Organometallic reagents for carbon-carbon bond formations.
8. Achieve the preparation of ylides and their synthetic utility.

Course name :-Pericyclic Reactions and Free Radicals

Course code:- (OCHET-602)

1. Understand the photochemical and thermal reactions.
2. Classify the various types of pericyclic reactions.
3. Apply the orbital correlation and frontier molecular orbital methods for pericyclic reactions.
4. Predict the stereochemical outcome of pericyclic reactions.
5. Understand various free radical reactions.

Organic Chemistry Laboratory Course

Course code:- (OCHEL-603)

1. Understand the multistep organic synthesis.
2. Explore the theoretical knowledge to predict the mechanism of reactions.
3. Explore the purification techniques.
4. Allow carry out various reactions.
5. Determine the overall yield of the reaction.

Course name :-Organic Chemistry Laboratory Course

Course code:- (OCHEL-604)

1. Understand the use of green chemistry principles.
2. Explore the use of microwave and ultrasound irradiation technique for the synthesis.
3. Explore the purification techniques.
4. Carry out various reactions.
5. Utilize the knowledge of spectroscopic techniques for structure elucidation.

Course name :-Organic Photochemistry and Green Chemistry

Course code:- (OCHETE-605)

1. Understand the photochemical and thermal reactions.
2. Classify the various types of photochemical reactions.
3. Predict the stereochemical outcome of photochemical reactions.
4. Understand the concept of green chemistry.
5. Utilize the knowledge of Microwave and Ultrasound assisted reactions for bioactive molecules.

Course name :-Synthetic Organic Chemistry

Course code:- (OCHETE-606)

1. Understand the types of reactions and rearrangements.
2. Predict the applications of named reactions and rearrangements in organic synthesis particularly natural products and drugs.
3. Allow to utilize the concept of carbon-carbon single and multiple bonds.
4. Understand the concept of Multicomponent reactions and their utility.

Course name :-Bioorganic and Enzyme Chemistry

Course code:- (OCHETE-607)

1. Understand the concept of bioorganic chemistry.
2. Know about the types of enzymes, structures.
3. Understand the applicability of various enzymes.

Course name :-Emerging Topics in Organic Chemistry

Course code:- (OCHETE-608)

1. Understand the concepts of multicomponent reactions and their mechanisms.
2. Understand the tandem reactions in organic synthesis.
3. Apply the principles of click chemistry in drug discovery, biology and materials chemistry.
4. Discuss the flow chemistry, micro reactors, separation techniques and process chemistry in organic synthesis.

Course name :-Research Project-I

Course code:- (OCHERP-649)

1. Know how to carry out literature survey by using various search engines and database.
2. Handle various chemicals, solvents, instruments and others.
3. Perform reactions, monitoring by TLC.
4. Purification techniques.
5. Understand the structure of organic compounds by using spectral techniques.

Course name :-Organic synthesis: Retrosynthetic approach

Course code:- (OCHET-650)

1. Under the basic concepts of retrosynthetic analysis.
2. Describe disconnection approaches applied on synthetic strategies and mechanism prediction.
3. Understand the use of protecting groups.
4. Allow to disconnect the molecules by using different strategies.
5. Explore the various reactions for designing the synthesis of target molecules.
6. Allow to construct the various rings.
7. Utilize the knowledge of retrosynthetic analysis and synthesis for natural products, drugs and complex molecules.

Course name :-Chemistry of Natural Products and Asymmetric Synthesis

Course code:- (OCHET-651)

1. Understand the concept of structure elucidation of natural compounds.
2. Build the synthetic schemes of natural products and bioactive molecules.
3. Analyze the stereochemistry of drug molecules.
4. Apply the knowledge of biosynthesis in total synthesis of organic molecules.
5. Design new synthetic methodologies.
6. Understand the concepts involved in asymmetric synthesis.

Course name :-Heterocyclic Chemistry

Course code:- (OCHETE-652)

1. Classify heterocyclic compounds and their nomenclature.
2. Understand the physical and chemical properties of simple and fused heterocyclic compounds.
3. Apply the knowledge of heterocyclic chemistry to synthesize the natural products and active molecules.
4. Distinguish aromatic and nonaromatic compounds using spectral data.

Course name :-Organic Chemistry Laboratory Course

Course code:- (OCHEL-653)

1. Understand the principles involved in separation and purification techniques.
2. Analyze the functional groups in organic molecules.
3. Understand the Principles involved in Separation of ternary mixtures.
4. Obtain practical experience in the Separation and identification of individual compounds in the ternary mixtures.
5. Develop the knowledge and skills in the synthetic organic chemistry useful for industrial applications.

Course name :-Introduction to Medicinal Chemistry

Course code:- (OCHETE-654)

1. Understand basic concepts of drug discovery.
2. Apply the concepts in lead discovery.
3. Identify the importance of Lipinski rule and bioisosterism.
4. Understand the concept of Pharmacokinetics and Pharmacodynamics.

Course name :-Drug Synthesis

Course code:- (OCHETE-655)

1. Understand classification of drugs.
2. Explore the knowledge of pharmacokinetics and dynamics of the drugs.
3. Understand the mode of action of drugs.
4. Explore the knowledge of synthetic organic chemistry to drug synthesis.

Course name :-Polymer Chemistry

Course code:- (OCHETE-656)

1. Understand the basic concepts in Polymer chemistry.
2. Learn the determination of molecular weight and properties of polymers.
3. Know about the polymer processing and polymerization techniques.
4. Explore synthesis and applications of commercial polymers and conducting polymers.

Course name :-Advanced Spectroscopy

Course code:- (OCHETE-657)

1. Analyze the concepts of 19F spectroscopy in determining the structures of molecules.
2. Apply the principles of 2D NMR spectroscopy in resolving the structures of organic molecules.
3. Discuss the principle of 31P and mass spectrometry and their applications.
4. Solve the structures of organic compounds using spectral data.

Course name :-Research Project-II

Course code:- (OCHERP-699)

1. Know how to carry out literature survey by using various search engines and database.
2. Handle various chemicals, solvents, instruments and others.
3. Perform reactions, monitoring by TLC.
4. Purification techniques.
5. Understand the structure of organic compounds by using spectral techniques.