GUJARAT UNIVERSITY
MSc Organic Chemistry Semester III and IV
Revised Syllabus
Design and Structure of Choice Based Credit System

(Effective from 2021-2022)

MSc Semester III						
Course		No. of hours per week (12 h for each unit and 48 h for each paper/course)			Total credits	Marks
Paper Code	Type	Lectures	Labs	Total		
CHE (O) 501	Core Paper	4	--	4	4	100
CHE (O) 502	Core Paper	4	--	4	4	100
CHE (O) 503	Core Paper	4	--	4	4	100
CHE (EO) 504	Elective Paper	4	--	4	4	100
CHE (O) 505 PR	Lab Course 1	--	6	6	4	100
CHE (O) 506 PR	Lab Course 2	--	6	6	4	100
	Total	16	12	28	24	600
MSc Semester IV						
Course		No. of hours per week (12 h for each unit and 48 h for each paper/course)			Total credits	Marks
Paper Code	Type	Lectures/ Discussion	DISS/PW and IT	Total		
CHE (O) 507	Core Paper (Scientific Writing)	4	--	4	4	100
CHE (O) 508	Core Paper (Report Writing)	4	--	4	4	100
CHE (O) 509	Core paper (Industrial Training, IT)/NET-GSET based Test	--	5	5	4	100
CHE (O) 510	Dissertation (DISS)/Project Work (PW)	--	15	15	12	300
		08	20	28	24	600

For each paper 30 % weightage is given to internal assessment and 70 % for external assessment.

CHE(O) 501 Natural Products and Bio molecules

Learning objective:

1. To understand the concept of biomolecules and natural product.
2. To understand the natural and synthetic pathways of the biomolecules and natural product.

Learning Outcomes

1. Learner can understand different types of steroids and hormones.
2. From Protein and peptides students will learn the topic and understand the importance of the same.
3. Study of different types of carbohydrates and their structures.
4. Students will learn the importance of nucleic acid in the DNA, RNA and proteins.

Unit I: Steroids and hormones

Introduction, Biogenesis of Steroids, Chemistry of cholesterol and ergosterol (no synthesis), Chemistry and synthesis of sex hormones (Testosterone, Oestrone, Progesterone) from cholesterol, Partial synthesis of Cortisone, Chemistry of bile acids, Plant hormones (auxins, heteroauxins, gibberellins)

Unit – II -Protein and peptides

Introduction of protein, Stereoisomerism in α-amino acid, Acid-base properties of amino acid, Isoelectric Points and Electrophoresis, Reductive Amination, Structure and nomenclature of peptides, Classification of amino acids, Disulfide linkages in peptides, Amino acids sequence determination in polypeptide, Modern synthetic approach for end group analysis, Solution-phase peptide synthesis, Solid-phase peptide synthesis

Unit – III-Carbohydrates

Introduction & definition, Classification, Types of glycosidic linkage, Chemistry of cellulose, Chemistry of starch, Chemistry of glycogen, Configuration of monosaccharides, Ring structure of monosaccharides, Disaccharides, Derivatives of polysaccharides

Unit – IV -Nucleic acid and Fatty acid

Compounds of nucleic acids, nomenclature of nucleotides, nucleosides, structure of DNA & chemical parameters, DNA, proteins, structure of RNA, chemical synthesis of purine nucleobases, Prebiotic chemistry, Synthesis of nucleosides, Chemistry of polymerase chain reaction, DNA sequencing: Sanger's di-deoxy method, Fatty acids, saturated fatty acids, unsaturated fatty acids, essentials fatty acids

Reference books:

1. Organic chemistry vol. I & II (sixth edition) I. L. Finar
2. Organic chemistry of natural products (Volume-1), Gurdeep R. Chatwal, Himalaya Publishing House
3. Chemistry of Natural products vol I & II by O.P.Agrawal
4. Chemistry of vitamins-S. F. Dyke
5. Chemistry of natural products by Bantely, Vol 1-10
6. Organic chemistry, L. J. Wade Jr., Prentice nall, England cliffs, 1987

CHE(O) 502 Advanced organic synthesis

Learning objective:

3. To understand the reaction mechanism of a chemical reaction, the path and the feasibility of a reaction.
4. To suggest synthetic route for complex organic compounds with stereochemistry.
5. To understand the techniques involved in the determination of mechanism of reacted ions and to propose methods to determine the mechanism of reaction.
6. To make the students understand and appreciate the concept of Stereochemistry and reaction mechanism.

Learning Outcomes

5. Learner can understand deep aspects of retrosynthesis and oxidation-reduction reaction.
6. Learner can understand synthesis of the important organic molecule.
7. Learner can be able to design new molecules of interest.
8. PCR and Conformational analysis can give understanding of how the reactions take place by bond shifting and geometry.
9. Protection groups concept is important to synthesized desired compounds to avoid side reaction/products during organic synthesis.

Unit-I- **PCR and Conformational analysis**

Introduction & classification, Electrocyclic reactions - introduction, definition and classification, Woodward-Hoffmann rules for electrocyclic reactions, Stereochemical aspects and modes of electrocyclic reactions, Cycloaddition reactions, Woodward- Hoffmann rules for cycloaddition reactions, Examples of thermal and photochemical [2p+2p] cycloaddition reactions, 1,3-Dipolar cycloaddition reactions, higher order cycloaddition reactions, Sigmatropic rearrangements - examples, Claisen and Cope rearrangements, Conformation and Configuration, Barriers to rotation, Conformation of ethane, propane, butane, Ring strain, Ring inversion of cyclohexane, Substituted cyclohexane, Decalins

Unit-II- Protecting groups

Role of protecting group in organic synthesis, principle of protection of hydroxyl (alcohol and phenol), amino [amine – (primary, secondary) and amide], carbonyl (ketone and aldehyde), carboxylic acid with different (minimum 5) reagents and their deprotection, synthetic equivalent groups (application of protection & deprotection approach with proper organic reaction).

Unit-III Retrosynthesis

Introduction and terminology, guidelines for disconnections, functional group inter- conversions, the importance of the order of events in organic synthesis, chemo selectivity, one group C-X and two group C-X disconnections, Natural reactivity' and 'umpolung', (epoxide, Haloketones and esters, 1,3 dithiane, cynide, Nitro, alkynes) C-C disconnection: Introduction, Alcohols, and carbonyl compounds, regioselectivity, alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis.

Unit IV: Oxidation-Reduction

Oxidation: Introduction, oxidation of hydrocarbons (alkanes, alkenes, aromatic ring), phenol, alcohols and diols, ketones (aldehydes, carboxylic acids and their derivatives), amines, hydrazine and sulphides.

Reduction: Introduction, reduction of hydrocarbons (alkenes, alkynes, aromatic ring), ketones (aldehydes, carboxylic acids and their derivatives, esters), anhydrides, nitrile, epoxides, nitro, nitroso, azo and oxime groups

Reference:

1. T. W. Greens, P. G. M. Wuts. Protective groups in Organic synthesis, 3rd / 4th Ed. John Wiley & Sons, INC
2. Organic chemistry- Clayden, Greeves, Warren and Wothers
3. Advance organic chemistry by Jerry March
4. Advance organic chemistry by Carey and Sundberg,
5. Advance organic chemistry by Francis A. carey
6. Designing Organic Synthesis, S. Warren, Wiley.
7. Organic Synthesis- Concept, Methods and Starting Materials, J. Fuhrhop and G. Penzillin, Verlage VCH.
8. Some Modern Methods of Organic Synthesis, W. Carruthers, Cambridge Univ. Press.
9. Handbook of Reagents for Organic Synthesis - Oxidizing and Reducing Agents
   Burke, Steven D., Danheiser, Rick L. (Eds.)

CHE(O) 503 Organic spectroscopy

Course Objectives:

1. To familiarize students with the most commonly used spectroscopic techniques.
2. Introduce basic and essential requirements to solve or understand the spectral problem.
3. Develop basic skills to interpret the spectra using spectroscopic data
4. To understand the basic spectroscopy of organic chemistry.
5. To understand the process and techniques of spectroscopy.
6. To learn the advancement of spectroscopy.

7. To understand the various techniques with advantages, disadvantages/limitations and application of spectroscopy in industrial aspects.

Learning Outcome :

1. The students will understand the concept, importance and scope of UV-Visible spectroscopy.
2. Evaluate the utility of UV/Vis spectroscopy as a qualitative and quantitative method.
3. The students will understand the concept and importance of IR spectroscopy.
4. The students will understand the role of infrared spectroscopy in the study of structure of organic compounds
5. The student will understand the concept and application of NMR (^{1}HNMR and ^{13}CNMR) in organic synthesis as well as medicinal chemistry.
6. Students will learn fragmentation patterns by Mass spectroscopy.
7. To be able to analyze and interpret the spectral data collected from different spectroscopic techniques.
8. To be able to solve problems related to the structure, purity, and concentration of chemicals.
9. To gain valuable insight into the types of molecular interactions by choosing suitable spectroscopic methods and interpreting the obtained data.

Unit – I UV-Visible & IR Spectroscopy

UV-Visible Spectroscopy
Introduction, Principle, Selection rules for electronic transition, Electronic transitions, Solvent effects, Chromophore and auxochrome, Different shifts, Instrumentation, Applications, Problems based on dienes, enones, benzoyl derivatives
IR Spectroscopy
Introduction, Principle, Selection rule, Important group frequencies, Modes of vibration, Degree of freedom, Different peaks, Preparation method for samples, Instrumentation

Unit-II 1H NMR and 13C NMR

1H NMR: Introduction, nuclear spin and magnetic nuclei, nuclear magnetic moment, behaviour of a bar magnet in a magnetic field, the

NMR transition measuring the chemical shift, shielding and de shielding of magnetic nucleus, chemical shifts in aliphatic and aromatic compounds, factors affecting chemical shift, Spin-spin splitting: effect of spin-spin splitting on the spectrum, mechanism of spin-spin splitting, chemical exchange, coupling constants (cis/trans, allylic system and aromatic ring); application of spin-spin splitting to structure determination-geminal-, vicinal-, long-range coupling; factors influencing geminal and vicinal coupling. simplification of the complex PMR spectra- (1) Increasing field strength (high resolution spectra), (2) Use of shift reagents, (3) Spin-spin decoupling (Double resonance), (4) Proton exchange, (5) Deuterium exchange, (6) Nuclear Over Hauser Effect (NOE) FT and two-dimensional NMR spectroscopy: principle of FT NMR- FIDs, Fourier transformation; 1 3C, 1 9F, 3 1P NMR-range of chemical shift values, spectra of typical examples; 2D NMR spectra- introduction and types of 2D techniques. 2D NMR Spectroscopy: Theory and Principles Of 2D NMR Spectroscopy (COSY); To interpret or to draw HOMCOR (1H-1H COSY, DQFCOSY, INADEQUATE),

13 CNMR: Introduction, difficulties and solution for recording 13C-NMR spectra; recording of 13C-NMR spectra – scale, solvents, solvent signals and their positions, multiplicity, 13C-1H coupling constant; proton coupled and decoupled 13C spectra, broad band decoupling, off resonance technique; Chemical shifts in 13C spectra – chemical shift calculation for alkanes, alkenes and alkynes, chemical shift calculation in internal and terminal substituted compounds, aromatic compounds; To identify structure from 13C NMR data; Use of 13C spectra in differentiating compounds/isomers; 13CDEPT Spectra – Differentiation in Primary, Secondary and Tertiary
Carbons by DEPT–45, DEPT–90, DEPT–135spectra.
HETCOR (13C-1H COSY, 1H-13C COSY i.e.
HMQC, HMBC), NOESY and TOCSY spectra.

Unit-III Mass spectrometry

Introduction, Determination of molecular weight and formulae, Parent peak, Base peak, Molecular ion peak, metastable peak, Ionization techniques (CI, FD, FAB, ESI, MALDI), Fundamental fragmentation process, Fragmentation patterns of organic functional groups, Examples of mass spectral fragmentation of organic compounds with respect to their structure determination.

Unit-IV Problems/interpretation structure/structure determination based on UV, IR, 1H NMR, 13C NMR, Mass spectrometry.

Spectral Problems Based on Combined Spectroscopy - DBE rules, Problems based on UV-Visible spectroscopy, Problems based on IR spectroscopy, Problems based on Mass spectrometry, Problems based NMR spectroscopy

Reference:

1. Spectrometric identification of organic compounds, T. C. Morril, R. M. Silverstein and G. Bassler, 6th edition, John Wiley and sons.
2. Introduction to spectroscopy, D. L. Pavia, G. M. Lampman and G. S. Kriz, 3rd Ed., Harcourt college publishers.
3. Organic spectroscopy by W.Kemp.
4. Spectroscopic methods in organic chemistry, D. H. Williams and Ian Fleming
5. Organic spectroscopy by P.S. Kalsi

CHE(EO) 504 ELECTIVE-1

Medicinal & Industrial Chemistry

Learning objectives :

1. Students will about the medicinal and industrial chemistry.
2. Learns will get knowledge of Drug design.
3. Learns can understand how to synthesis various drugs.
4. Learns can understand how to purify various products at Research (R & D) labs and industrial scale.

Learning outcomes:

1. Drug design is the important task since the discovery of drug and in future drugs are the need of the society. Learns will understand the concepts of how to develop drug.
2. Learns will understand what are antibiotics and where/when to use them.
3. The chemist (learns) should know how to synthesis the drugs by best route of synthesis.

4. For any chemical products the raw materials are required. The learns will learn how to synthesize the raw materials by green chemistry aspects.
5. Learns will learn that how to isolate and purify the products at chemical industries.

Unit – I -Drug Design, Antibiotics and antimalarial (with SAR, MOA)

Drug Design

Introduction, naming of organic medicinal compounds, development of new drugs, procedure (conventional and recent/modern) followed in drug design, concept of lead compound and lead modification, pro drugs, soft drugs and hard drugs, phase I, II and III clinical trials, structure activity relationship, theories of drug activity : occupational theory, rate theory, induced fit theory, quantitative structure activity relationship. Concept of drug receptors, elementary treatment of drug receptor interactions, physio chemical parameters lipophilicity, partition coefficient, electronic ionization constant. Introduction to drug discovery by CADD - Structure and property, ADME-rules, concept of QSAR & 3-D QSAR, Pharmacophore, Enzymes/proteins structures/docking. Software used in drug design.

Antibiotics and antimalarial (with SAR and MOA)

Introduction, general classification, structural variations, synthesis and medicinal uses of the following :

Antibiotics: Penicillin, tetracycline, chloroamphenicol.

Antimalarial: Antimalarial agents based on 4-amino and 8-amino.

Unit –II –Organic synthesis of imp drugs (psychoactive, cardiovascular, hypoglycemic, anti-TB, antimalarial)

Psychoactive drugs

Thiopental, amobarbital, diazepam, chlorozepan, alprazolam, glutethimide, nikethamide, procaine, lidocaine and dibucaine, Ibuprofin, meclofenate sodium, novalgin, pethidine

Cardiovascular, diuretics and hypoglycemic drugs

Synthesis of amyl nitrate, diltiazim, atenolol, methyl dopa, tolbutamide, chloropropamide, glibenclamide, acetazolamide, chlorothiazide, furosemic and ethacrycnic acid

Antimalarial drugs

Mefloquines, chloroquine, primaquine and daraprim

Antituberculosis drugs
Isoniazid (INH), Ethionamide, Ethambutol, DDS (Dapsone)

Unit – III- Basic principle and unit process (by Convention and Green chemistry aspects) in organic chemistry/industry

Basic principle at chemical industry

Basic chemical data (including MSDS), flow charts, chemical process selection, batch versus continuous operation. Safety – general safety, safety during handling of chemicals, fire safety. Hazardous - toxic chemical materials (Solid, liquid and gas), precaution and action taken during accident by chemicals. Patents and its importance in Research and development/chemical industry. Good manufacturing practice (GMP) and Good laboratory practice (GLP).

Unit process (in organic chemistry) at chemical industry

Nitration, Halogenation, Sulphonation and Amination methods and industrial chemicals derived from benzene, naphthalene using unit process by Convention and Green chemistry aspects (Green catalyst, Name reactions associated with green chemistry, one pot reaction, MCR, use of MW, Ultra sonic/sound) for each unit process with suitable examples.

Unit – IV - Separation (chromatography & Unit operations) Techniques and Applications in organic chemistry

Chromatography Techniques

TLC, HPTLC, GC, HPLC/LC, SFC, Column Chromatography, Combi Flash -…

Unit operations in organic chemistry –

Filtration – Different types of filtration techniques, filter aid and filter media.

Distillation - Different types of distillations with their pros and cons.

Extraction – Solid from solids and liquid from liquids using suitable reagents.

Drying – Using ovens, spray tower, plate and frame dryer

Reference:

1. Burger's medicinal chemistry and drug design (5/e) 1997, vol 1 to 5 edited by Manfred E.Woltt (John wiley and sons Mc. New york)
2. Principles of medicinal chemistry by William A. Foye (ied), lea and febiys (Philadelphia)
3. Principles of medicinal chemistry vol I & II (5/e) F.S.kadam, K.R. Mahadic ad K.G.Bohra (Nirali publication)
4. Medicinal chemistry by ashutosh kar
5. The organic chemistry of drug synthesis vol I, II and III (1980) ed by D. lednicer and L.A. mitscher (Johyn wiley and sons, New york)
6. Wilson and Gisvold text book of organic medicinal and pharmaceutical chemistry (5/e,1982) by Robert Doerge (J.B. lippincoff company, phaladophia/ Toppan co.Ltd, Tokyo)
7. Topics in medicinal chemistry vol I & II by rabinowitz Myerson (interscience 1968)
8. The pharmaceutical basis of therapeutics by Geoman and Gilman (Mcmillan co.)
9. Unit processes in organic synthesis by P. H. Groggins
10. Industrial Chemical process by R. N. Shreve
11. Riegels handlook of industrial chemistry by James and Kent
12. Dryden's outlines of chemical Technology M. Gopal Rao

CHE(EO) 504 ELECTIVE-2

ESSENTIALS OF OXIDATION, REDUCTION AND C-C BOND FORMATION. APPLICATION IN ORGANIC SYNTHESIS

https://nptel.ac.in/courses/104/101/104101127/#

COURSE PLAN:

Week 1: Introduction to organic synthesis, importance of selectivity and basics of oxidation of alcohols and development of sulfur based oxidations: Swern

oxidation and related concepts; Continuation of Swern oxidation and the utility of intermediates derived from Swern oxidation including Pummerer intermediates; Oxidations using selenium compounds such as SeO2 and organoselenium compounds

Week 2: Dess-Martin, IBX and related hypervalent iodine based oxidations; Silver carbonate/celite, Prevost reactions and its modern variation. Microbial oxidations such as Pseudomonas Putida etc. Week 3: Oxidations with RuO4 and other Transition metal catalysed oxidations; Tamao-Fleming Oxidation; Oxidations with Dimethyl dioxirane (DMDO) and 2-sulfonyloxaziridines and chiral versions; Oxidations at unfunctionalised carbons, Photosensitized oxidations

Week 4: Reduction of Carbonyl compounds with Boron and Aluminium based reagents such as Luche Reduction, NaCN(BH3), DIBAL, Red-Al, L-and K-Selectrides, Superhydrides and associated selectivities.

Week 5: Low Valent Titanium species and Microbial reductions (NADH model etc.); Dissolving Metal Reductions; Reduction with Silanes

Week 6: Sharpless epoxidation and synthetic utility of the chiral epoxy alcohols; Katsuki-Jacobsen epoxidation and mechanistic details; OsO4 based and related Sharpless Asymmetric Dihydroxylation

Week 7: Coreys oxazaborilidines in asymmetric reductions; Noyoris Ruthenium catalysed reduction of ketones; Asymmetric Hydrogenations with BINAP

Week 8: C-C Bond formation via Carbanions alpha to electron withdrawing groups; Boron and Silicon Enolates: Formation and Use in C-C Bond Formation; Imines in C-C Bond Formation; Simmons-Smith Cyclopropanation in Organic Synthesis

Week 9: Use of Allyl Boron, Allyl and Vinyl Silanes and Allyl Tin compounds in C-C Bond Formation

Week 10: Introduction to SAMP and RAMP chiral ligands for asymmetric C-C bond formation; Introduction to Oppolzers Sultam based chiral ligands and their reactions for organic synthesis; Evans Oxazolidinone for asymmetric synthesis

Week 11: Synthesis of selected natural products using above discussed methods of oxidation, reduction and C-C Bond formations

Week 12: Synthesis of selected natural products using above discussed methods of oxidation, reduction and C-C Bond formations

CHE(O) ELECTIVE-3

REAGENTS IN ORGANIC SYNTHESIS

https://nptel.ac.in/courses/104/103/104103111/

COURSE PLAN:

Week 1: Oxidizing Agents in Organic Transformations-Part-I

Week 2: Oxidizing Agents in Organic Transformations-Part-II

Week 3: Reducing Agents in Organic Transformations-Part-I

Week 4: Reducing Agents in Organic Transformations-Part-II

Week 5: Organic Transformations-Using Non-Transition Metals Part-I

Week 6: Organic Transformations-Using Non-Transition Metals Part-II

Week 7: Organic Transformations-Using Non-Transition Metals Part-III

Week 8: Organic Transformations-Using Transition Metals Part-I

Week 9: Organic Transformations-Using Transition Metals Part-II

Week 10: Organic Transformations-Using Transition Metals Part-III

Week 11: Organic Transformations-Using Transition Metals Part-IV

Week 12: Organic Transformations-Using Lanthanides Reagents

CHE(O) 505 PR & CHE(O) 506 PR

One or multi step preparation of Organic compounds and study of reaction, mechanism, mole ratio calculation, TLC, purification, confirmation by chemical method, UV, IR, Mass and NMR value of compound (Theoretical)

CHE(O) 505 PR

Product 35 (Reaction mechanism -10, Crude and crystal 20, Calculation & M.P./B.P - 5), Viva 15, TLC & Spectral data 20 = 70 Marks

Total marks 100 = 70 (External) + 30 (Internal)

1. p-Bromo benzene from Bromobenzene
2. Benzanilide from Benzoyl chloride & Aniline– Schotten Baumann Reaction
3. Hippuric acid from Benzoyl chloride & Glycine
4. Sulphanilic acid from Aniline
5. Sym-tribromobenzene from Aniline
6. m-Nitro phenol from m-Nitro aniline
7. Phenylazo-2-naphthol from aniline & 2-Naphthol
8. Diazobenzene from aniline
9. p-amino azabenzene - Diazobenzene & aniline
10. Hydrazobenzene from Nitrobenzene
11. Benzidine from Hydrazobenzene
12. p-Nitrophenylhydrazine from p-Nitroaniline
13. Cinnamic acid (Perkin reaction) from Benzaldehyde
14. Benzanilide from Benzophenone (Becmann reaction)
15. p-Benzoquinone – Hydroquinone

CHE(O) 506 PR

Product 35 (Reaction mechanism -10, Crude and crystal 20, Calculation & M.P./B.P - 5), Viva 15, TLC & Spectral data 20 = 70 Marks

Total marks 100 = 70 (External) + 30 (Internal)

1. Anthanilic acid from Phthalimide
2. Benzilic acid from benzoin (Benzilic acid rearrangement)
3. Benzimidazole/2-methyl benzimidazole from o-phenylene diamine
4. Adipic acid from Cyclohexanol
5. 4-Amino benzoic acid from 4-Nitro toluene
6. 4-Methyl-7-acetoxy coumarin from Resorcinol
7. p-Ethoxy acetanilide from p-Amino phenol
8. p-Bromoaniline from Acetanilide
9. Benzotriazole from o-phenylenediamine
10. p-Bromo aniline from aniline
11. Salicyldehyde from phenol
12. m-Nitro Phenol from m-nitro aniline
13. 8-nitro quinolone from o-nitro aniline
14. Congo red from Benzidine
15. Phenolphthalein from phenol

Reference:

1. *Small scale preparations by Arther I.Vogel*
2. *Practical Organic Chemistry, fourth edition by Mann & Saunders*
3. *http://orgsyn.org/ (Organic syntheses)*

Sem. IV

CHE(O) 507 Scientific Writing

- Writing of Research Article/Review Article/Commentary Article/Case Study/ Monograph/Book Chapter/Book Review/Research Proposal or any other scientific article type.
- The student can select any one scientific writing type or research proposal and submit a copy (hard and soft) of the same for internal and external evaluation.
- Evaluation shall be centered around on novelty, relevance, significance, and impact.
- Additional weightage will be given for submission/publishing of any article type in any journal (University journal or a journal that is indexed in the UGC CARE list/Web of Science/ SCOPUS/SCI/SCIE etc.) or a research proposal.

Guidelines for Scientific Writing

Research Article

Presents a full report with new results on a specific topic. Complete experimental details with proper justification. Generally not limited in length, with figures, tables, and references. Format…Title, Authors, Abstract, introduction, experimental, results, discussion, conclusion, acknowledgment, references

Review Articles/Commentary Article

Gives an overview of research in a particular field. It can be on one's own research or any other topic of general and current interest. Organized differently from communications or research articles as it does not have primary experimental data. Data of existing literature can be presented in a tabular format, graphs, diagrams, figures, charts etc. Should be referenced as thoroughly as possible. Format…Title, Authors, Abstract, introduction, discussion, conclusion, acknowledgment, references

Case Study

This study represents person, group, or situation that has been studied over time. Format depends upon the type of study.

Monograph

Title, Author, Introduction: Reason to select a topic; History, timeline, and Scientific/social significance; Benefits to the scientific community, teaching, and research, Development: Exposition of ideas into paragraphs or chapters.
"Quote that authors endorse these ideas." Conclusion: Status and future perspectives, References: Should be referenced as thoroughly as possible

Book Chapter

Title, Authors, Abstract, Introduction/Background on the topic, Discussion (with subdivisions): Text with tables, figures, charts etc., Summary/Conclusion: Status and future perspectives, References

Book Review

A book review is a thorough description, critical analysis, and/or evaluation of the quality, meaning, and significance of a book, often written in relation to prior research on the topic.
Scope/Purpose/Content, Note the Method/Methodology of writing, Critically Evaluate the Contents, Examine the Front Matter and Back Matter, Summarize and Comment.

Research Proposal

Title, Research Problem/Problem Statement, Rational/Purpose of the Study Review of the Literature, Proposed Research Framework, Research Questions/Proposed Hypothesis, Significance, Proposed Methods and Procedures, Deliverables/Expected Outcomes, Execution timelines, year wise breakup, Financial aspects, References

References

1 *"A Manual for Writers of Research Papers, Theses, and Dissertations"*, Kate Turabian, University of Chicago Press, 8th Edition, 2013.
2 "*Concise Guide to Writing Research Papers (Perfect Phrases Series)"*,Carol Ellison**,** McGraw-Hill Education; 1st Edition, 2010.

CHE(O) 508 Report Writing

- Report Writing for Participation and/or presentation (Poster/Oral/Invited talk as applicable) in University/State level/National/International Seminar/ Conference/Webinar/ Symposium/Workshop/Hands-on training /Software learning of at least 2 days. In case of one day seminar/ webinar/ conference/workshop, it is mandatory to participate in two such events.
- Evaluation will be based on detailed technical report prepared on the conference/seminar/workshop participated and for Poster/Oral presentation, as applicable.
- Additional weightage will be given for Poster/Oral presentations.

Guidelines for Report Writing

It aims to summarise the most important talks/research presented. It is not usually feasible to attempt comprehensive coverage of the conference. More focus should be on those presentations that are most topical, interesting, or thought-provoking.

Points to consider when writing the report:

- Name of Institute/Department/University that organized the conference
- Title and theme of the conference
- Information regarding number of attendees, where and when it was held (date), name of the convener, organizing secretary etc.
- Include a copy of the brochure
- A brief about the Inaugural Session
- Details of all the technical sessions
- List of main speakers, their position/designation, topic, expertise, and their institutional affiliation
- Highlight research paper(s) or work with major significance and impact
- A brief about the Concluding/Valedictory Session
- Embed the text with photographs wherever possible
- The outcome/summary: Your learning

References

1 *"Writing for Conferences: A Handbook for Graduate Students and Faculty"*, Leo Mallette, Clare Berger, Greenwood; Illustrated Edition, 2011.

2 *"The Creative Writing Handbook"*, John Singleton (Editor), Mary Luckhurst (Editor), Red Globe Press; 2nd Edition, 1999.

CHE(O) 509 Industrial Training/ NET-GSET based Test

Guidelines for Industrial Training

1 Each student must undergo 3 weeks industrial training under the supervision of a faculty from the concerned department.

2 The industry may be in Ahmedabad, Gujarat or anywhere in India.

3 The training may be obtained at any R&D, QA, QC, Production or any other relevant department on different instrumental techniques or other laboratory equipments.

4 The students must submit a report on the training obtained from the industry which may include (a) introduction about the industry (b) various activities of the industry (c) the process which are used in the industry (d) the products of the industry and (e) summary and conclusion.

5 The report submitted by each student would be assessed by the branch in-charge and the supervising teacher.

6 The student must discuss/present the details of the training through a power point presentation

NET-GSET based Test

50% form Sem. I & II, 50% from Sem. III syllabus but the question/exam pattern will be based on CSIR-NET or GSET.

CHE(O) 510 Dissertation

Guidelines for Dissertation/Project Work

1 Each student must carry out a project under the supervision of a faculty from the concerned department.

2 The project can be carried out either in the department or in any other industry, institute or organizations located in Ahmedabad, Gujarat or anywhere in India.

3 The topics of the dissertation can be selected from any of the four branches of chemistry i.e., Organic, Inorganic, Physical or Analytical. The topic can be related to (a)synthesis, purification, characterization, application of organic compounds or (b)metal complexes preparation and applications or (c)physical studies of various systems (d) method development and validation (e) green chemistry (f) nanomaterials preparation and applications (g) functionalized supramolecules (h) electro analytical methods (i)environmental analysis and decontamination or any other related to the subject.

4 Each student must submit a dissertation on the topic of their study comprising of (a) an introduction on the topic along with literature survey and justification for the selection of the topic (b) materials and methods (c) methodology (d) results and discussion and (e) summary and conclusion along with the references.

5 Each student must give monthly report and a midterm presentation of their work at the department.

6 The student must discuss/present the details of dissertation through a power point presentation.

7 Dissertation would be examined by the supervising teacher and external examiner.