GUJARAT UNIVERSITY
MSc Physical Chemistry Semester III and IV
Revised Syllabus
Design and Structure of Choice Based Credit System
(Effective from June 2023)

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 (P) 501	Core Paper	4	--	4	4	100
CHE (P) 502	Core Paper	4	--	4	4	100
CHE (P) 503	Core Paper	4	--	4	4	100
CHE (EP) 504	Elective Paper	4	--	4	4	100
CHE (P) 505 PR	Lab Course 1	--	6	6	4	100
CHE (P) 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/ IT/Lab course	Total		
CHE (P) 507	Core Paper (Scientific Writing)	4	--	4	4	100
CHE (P) 508	Core Paper (Report Writing)	4	--	4	4	100
CHE (P) 509	Core paper (Industrial Training and Industrial Visit)	--	4	4	4	100
CHE (P) 510	Core Paper [Professional Chemistry Test (Last 5 Years NET questions)]	4	--	4	4	100
CHE (P) 511	Dissertation (DISS)/ Project Work (PW) OR Lab Course	--	12	12	08	200
		12	16	28	24	600

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

M. Sc Semester-III
CHE(P) 501 Advanced Physical Chemistry

	Learning Objectives:
1.	To describe the assumptions made in the Kinetic theory of gases, To describe how the distribution of speed of gases change with temperature, To understand the significance of Kinetic molecular theory of gases which describe the behavior of gases.
2.	To brief about principle of FTIR spectroscopy, to explain about the fundamentals of the bonds.
3.	To explain about classical and quantum theories of Raman spectroscopy, applications of Raman Spectroscopy.
4.	To brief about the different properties of solid. To discuss about the liquid crystals.
	Learning Outcomes:
	After the end of the course student will be able to
1.	Calculate the distribution of speeds, explain the behavior of gases.
2.	Interpret FTIR spectroscopy, Explain the working principle and taking spectrum of IR spectroscopy device.
3.	To understand the basic principle of Raman spectroscopy and its various applications.
4.	Use the properties the solids

Unit-I	**Gaseous state of matter:** Introduction, Baromatric distribution law, Maxwell's law of distribution of molecular velocities, effects of temperature and significance, Maxwell distribution as energy distribution, Types of molecular velocities: Average, root mean square and most probable velocities, equipartition of energy and quantization, The kinetic gas equation, Kinetic energy and temperature.
Unit-II	**IR and FT-IR spectroscopy:** Introduction, Vibration in diatomic molecules, Harmonic oscillations in diatomic molecules, An harmonic Oscillations in diatomic molecules, Selection rules, Force constant, Bond strength and bond length, Simultaneous vibration and rotational transitions, FT-IR : Principles and techniques.
Unit-III	**Raman Spectroscopy:** Introduction, Light scattering by molecules, Classical and quantum theory of Raman effects, Pure rotational, Pure vibrational and vibrational and rotational Raman spectra and selection rules, general mechanism of Raman effect, Raman effects in liquids, gases and solids, Applications of Raman effect in Physical Chemistry.
Unit-IV	**The solid state:**

	Introduction, Mechanical properties of solids: Electrical properties of solids: conductors, Insulators and semiconductor, super conductors, Band theory of solids, insulators and semiconductors, super conductors, BCS theory of super conductors, Magnetic properties of solids, liquid crystals and its applications. Ferro magnetism and anti ferromagnetism, measurements of magnetic susceptibilities.

References:

1. Introduction to Physical Chemistry-Glasstone
2. Physical Chemistry-Atkins
3. Advanced Physical Chemistry-Gurdeep Raj: Goel publishing House
4. Comprehensive Physical Chemistry-N. B. Singh, N. S. Gajbhiye, Shiva Saran Das: New Age International Publication
5. Advanced Physical Chemistry-J. N. Gurtu and A. Gurtu, Pragati prakashan
6. Wiley Engineering Chemistry Second Edition
7. Molecular Spectroscopy-C. N. Banwell and E. M. McCash: Mc Graw Hill Education
8. Introduction to Molecular Spectroscopy-G. M. Barrow: Mc Graw Hill Education
9. Physical Chemistry for the Chemical and Biological Sciences-Raymond Chang: University Science Books
10. Handbook of Instrumental Techniques for Analytical Chemistry-Frank A. Settle, Editor: Pearson Education
11. Basic Principles of Spectroscopy-R. Chang McGraw Hill
12. Instrumental methods of Analysis-Skoog and West
13. Instrumental Methods of Chemical Analysis-B. K. Sharma: Krishna Prakashan Media(P) Ltd. Meerut
14. Physical Methods of Chemistry-R. S. Drago
15. Principles of Solid State-H. V. Keer
16. Solid State Chemistry-N. B. Hannay
17. Solid State Chemistry-C. N. R. Rao
18. Solid State Chemistry-R. C. Ropp: Elsevier
19. Principles of Physical Chemistry-Puri, Sharma and Pathania: Vishal Publishing Co.
20. Textbook of Physical Chemistry-p. L. Soni, O. P. Dharmarha and U. N. Dash: Sultan Chand and Sons
21. Physical Chemistry-Dr. S. Parari: New Central Book Agency (p) Ltd.

M. Sc Semester-III
CHE(P) 502 Selected topics in Physical Chemistry

	Learning Objectives:
1.	To discuss about the exchange of mass, energy in the gaseous system, to discuss about the collision parameters.
2.	To brief about the different properties of solid.
3.	To discuss about the basic principle of absorption, application of the principle,
4.	To discuss about the laws of photochemistry, to discuss about the earth atmosphere,
	Learning Outcomes: Upon completion of the course student will be able to
1.	Understand the mass and energy transfer of the gases, able to calculate the molecular parameters, mean free path, collision frequency.
2.	Determine the structure of Crystalline materials, determine the particle size. The crystal size distribution in study the reaction rate.
3.	Can explain the origin of UV visible absorption spectra, detect environmental contamination.
4.	To form some typical compounds and cleaning agents.

Unit-I	**Transport phenomenon in gases:** Introduction, Transport properties: Thermal conductivity, viscosity and diffusion, Collision parameters: collision diameter, collision cross section, collision number, collision frequency, mean free path, van der Waals equation of state for real gases, Graham's law of effusion and diffusion.
Unit-II	**Diffraction techniques:** Introduction, The Bragg's equation, Structural determination by X-rays: Powder method, Laue method, Debye-Scherrer method, Indexing and determination of lattice parameters of a unit cell of NaCl, Graphical method of indexing, Rietveld analysis, determination of particle size of crystallites.
Unit-III	**Visible and electronic spectroscopy:** Introduction, Lambert-Beer's law, regression and correlation coefficient, Ringbom plot, Applications: analysis of mixtures, determination of Pka, electronic spectra of diatomic molecules, Franck-Condon principle, Concept of potential energy curves for bonding and antibonding molecular orbitals, selection rules, molecular orbitals their energy levels, and respective transitions.
Unit-IV	**Photochemistry:** Introduction, Laws of photochemistry: First law, second law stark Einstein law of photochemical equivalence, quantum efficiency, low and high quantum yield,

	experimental method for the determination of quantum yields, action spectrum, Earth's atmosphere: composition of the atmosphere, region of the atmosphere, Residence time, The Greenhouse effect, photochemical smog, formation of nitrogen oxide, formation of O_3, secondary pollutants, harmful effects and prevention of photochemical smog.

References:

1. Introduction to Physical Chemistry-Glasstone
2. Physical Chemistry-Atkins
3. Advanced Physical Chemistry-Gurdeep Raj: Goel publishing House
4. Comprehensive Physical Chemistry-N. B. Singh, N. S. Gajbhiye, Shiva Saran Das: New Age International Publication
5. Advanced Physical Chemistry-J. N. Gurtu and A. Gurtu, Pragati prakashan
6. Wiley Engineering Chemistry Second Edition
7. Molecular Spectroscopy-C. N. Banwell and E. M. McCash: Mc Graw Hill Education
8. Introduction to Molecular Spectroscopy-G. M. Barrow: Mc Graw Hill Education
9. Physical Chemistry for the Chemical and Biological Sciences-Raymond Chang: University Science Books
10. Handbook of Instrumental Techniques for Analytical Chemistry-Frank A. Settle, Editor: Pearson Education
11. Basic Principles of Spectroscopy-R. Chang McGraw Hill
12. Instrumental methods of Analysis-Skoog and West
13. Instrumental Methods of Chemical Analysis-B. K. Sharma: Krishna Prakashan Media(P) Ltd. Meerut
14. Physical Methods of Chemistry-R. S. Drago
15. Principles of Solid State-H. V. Keer
16. Solid State Chemistry-N. B. Hannay
17. Solid State Chemistry-C. N. R. Rao
18. Solid State Chemistry-R. C. Ropp: Elsevier
19. Principles of Physical Chemistry-Puri, Sharma and Pathania: Vishal Publishing Co.
20. Textbook of Physical Chemistry-p. L. Soni, O. P. Dharmarha and U. N. Dash: Sultan Chand and Sons
21. Physical Chemistry-Dr. S. Parari: New Central Book Agency (p) Ltd.

M. Sc Semester-III
CHE(P) 503 Polymer Chemistry

	Learning Objectives:
1.	The objectives of the course are to explain about concept of molecular weight, methods of determining molecular weight, to explain about the concept of molecular weight distribution,
2.	To describe about the molecular structures and its significance, effect of temperature of properties of polymers.
3.	To describe the effect of size and shape of polymers on its properties
4.	To describe about thermodynamics and processing of Polymers and its application.
	Learning Outcomes:
1.	To synthesize polymers and to determine the molecular weight by different methods,
2.	To process polymers by different processes,
3.	The knowledge of polymers helps to use in different fields.
4.	Change the properties by applying the principle of thermodynamics and characterize polymers.

Unit-I	**Polymer molecular weight and characterization:** Introduction, concepts of molecular weight distribution, Measurements of molecular weight and size: Viscosity, light scattering, osmometry and ultracentrifuge methods, Molecular weight and degree of polymerization, polydispersity and molecular weight distribution in polymers, The practical significance of Polymer molecular weight, size of polymer molecules.
Unit-II	**Structure and properties of polymers:** Introduction, polymer microstructure, microstructures based on the chemical and geometrical structure, Crystlline structure of polymers, Glass transition temperature (Tg) and molecular weight, Glass transition temperature and melting point, importance of glass transition temperature, The mechanical properties of crystalline polymers, Properties involving large deformation: Melting point, tensile strength and related properties.
Unit-III	**Polymer processing:** Plastic technology: compression molding, injection molding, blow molding, rotational molding and thermoset molding, Extrusion, coextrusion, film extrusion, pultrusion, calendering, casting. Fiber technology: Textile and fibric properties, spinning, fiber after treatments.

Unit-IV	**Polymer solutions:** Introduction, the process of polymer dissolution, Thermodynamic of polymer solution, The Flory-Huggins theory of polymer solution, nature of polymer molecules in solution, Size and shape of macromolecules in solution, viscosity of diluted and concentrated polymer solution.

References:

1. Polymer chemistry - Flory
2. Polymer science - Hiemenz
3. Text Book of Polymer Science - Fred W. Billmeyer: Wiley
4. Principles of Polymer Science - P. Bahadur and N. V. Sastry: Narosa Publishing House
5. Polymer Science - V. R. Gowariker, N. V. Viswanathan and Jayadev Sreedhar: New Age International Publisher
6. Wiley Engineering Chemistry Second Edition
7. Specialty polymers – R. W. Dyson
8. Polymer characterization -E. Shroder, Hanser publication
9. Polymer process engineering – R. G. Dyson
10. Physical Chemistry of polymers – A. Tager, Mir publication, Moscow
11. Polymer chemistry – B. K. Sharma, Krishna prakashan, Meeraut

M. Sc Semester-III
CHE(EP) 504 Elective Paper-I (Special topics in Physical Chemistry)

	Learning Objectives:
1.	To explain about enzymes and how it binds to an active site in the substrate and feasibility of reaction and reaction rate.
2.	To focuses on importance of enzymes in biological processes and their functions and the effects of different factors.
3.	To explain the classification of nano materials, types and their synthesis.
4.	To describe various techniques to determine the structure.
	Learning Outcomes:
1.	The student can able to describe and explain the basic principles of enzyme catalytic process.
2.	Student can able to describe and explain the chemistry of oxygen binding to hemoglobin and myoglobin
3.	Able to classify nano materials, can able to synthesis nano particles
4.	Can able to understand the principles of instrumental techniques and determine the structures, properties and uses.

Unit-I	**Enzyme catalysis:** Introduction, General principles of catalysis, Phase transfer catalysis, the equation of enzyme kinetics, Michaelis-Menten kinetics, steady-state kinetics, significance of K_M and V_{max}, Allosteric Interactions: Oxygen binding to Myoglobin and Hemoglobin, The Hill equation, Conformational Changes in Hemoglobin induced by Oxygen binding.
Unit-II	**Enzyme Applications:** Enzyme applications in Pharmaceuticals, The food-water-fuel nexus, Natural gas Conversation, food and Beverage industries, Flavors, Aromas and detergent industries.
Unit-III	**Nano materials-I:** Introduction, Classification of nano materials, Synthesis, Synthesis of Gold nano particles, Different types of nano structures: nanoparticles, nanowires, nanorods, nanotubes, nanofilms, C-nanotubes and nanoclusters. Advantages of nanoparticles,
Unit-IV	**Nano materials-II:** Introduction, Characterization: Scanning electron microscopy (SEM), Transmission electron microscopy (SEM), Scanning Tunneling microscopy, Atomic force microscopy (AFM), X-ray diffraction, Fluorescence spectroscopy. Applications.

References:

1. Advanced Physical Chemistry-Gurdeep Raj: Goel publishing House
2. Comprehensive Physical Chemistry-N. B. Singh, N. S. Gajbhiye, Shiva Saran Das: New Age International Publication
3. Wiley Engineering Chemistry Second Edition
4. Principles of Physical Chemistry-Puri, Sharma and Pathania: Vishal Publishing Co.
5. Textbook of Physical Chemistry-P. L. Soni, O. P. Dharmarha and U. N. Dash: Sultan Chand and Sons
6. Physical Chemistry-Dr. S. Parari: New Central Book Agency (p) Ltd.
7. Nanoparticles – Mechanics and Mechanisms – K. T. Ramesh
8. L. Foster, Nanotechnology: Science, Innovation and opportunity, prentice Hall.
9. G. Cao, Nanostructures and Nanomaterials: Synthesis, Properties and Applications – Imperial College Press, London, 2004

M. Sc Semester-III
CHE(EP) 504 Elective Paper-II Polymer Chemistry

	Learning Objectives:
1.	To discuss about characterization of polymers, solubility of polymers and the thermodynamics and related thermal properties
2.	To brief about various processing techniques and the properties associated with various forms of polymers
3.	To discuss about various reactions and its uses to prepare polymers with specific properties
4.	To explain the various techniques to analyze and testing of polymers
	Learning Outcomes:
1.	Student will be able to characterize polymers and be able testing various properties
2.	Can be able to understand various processing techniques and its various applications
3.	Student can be able to prepare various polymers with different properties using various reaction mechanisms
4.	Be able to understand the various instrumental techniques and be able to analyze and testing of various polymers

Unit-I	**Characterization of Polymers:** Introduction, Polymer solution: Criteria of polymer solubility, Conformations of dissolved polymer chain, Thermodynamics of polymer solutions, Solution viscosity and molecular size, Physical testing:- Mechanical properties: Stress-strain properties in tension, Impact tests, Hardness, Thermal properties: Softening temperature, Chemical properties: Resistance to solvent, Weathering.
Unit-II	**Polymer Processing;** Introduction, Plastic technology:- Molding: Compression molding, Injection molding, Blow molding, Rotational molding, Extrusion, Calendering, Coating, Foaming, Fiber technology: Fiber properties and spinning.
Unit-III	**Polymer Reactions:** Introduction, Hydrolysis, Aminolysis, Hydrogenation, Reaction of Various specific groups: hydroxyl group, Aldehyde group, Ketonic and carboxylic groups, Cross-linking reactions, Block and Graft copolymers: Grafting by means of free radicals and through functional groups,
Unit-IV	**Analysis and Testing of Polymers:** Analysis of Polymers by Infrared Spectroscopy, NMR Spectroscopy, X-Ray diffraction, Microscopy: Electron microscopy, Scanning electron microscopy, Thermal Analysis and Applications: Thermogravimetric analysis, Differential thermal analysis, Differential scanning Calorimetry.

References:

1. Polymer chemistry - Flory
2. Polymer science - Hiemenz
3. Text Book of Polymer Science - Fred W. Billmeyer: Wiley
4. Principles of Polymer Science - P. Bahadur and N. V. Sastry: Narosa Publishing House
5. Polymer Science - V. R. Gowariker, N. V. Viswanathan and Jayadev Sreedhar: New Age International Publisher
6. Wiley Engineering Chemistry Second Edition
7. Specialty polymers – R. W. Dyson
8. Polymer characterization -E. Shroder, Hanser publication
9. Polymer process engineering – R. G. Dyson
10. Physical Chemistry of polymers – A. Tager, Mir publication, Moscow
11. Polymer chemistry – B. K. Sharma, Krishna prakashan, Meeraut

M. Sc Semester-III
CHE(EP) 504 Elective Paper-III Catalysis

	Learning Objectives:
1.	To discuss briefly about classification of catalytic process, theory related to catalytic processes characterization and its applications
2.	To brief about homogeneous catalysis, the method of its preparation and its applications
3.	To discuss about the principle of PTC, advantages, structures and related properties of crown ethers
4.	To brief about some industrial PT processes and its application
	Learning Outcomes:
1.	Student can be able to classify, compare and can understand the general features of various catalytic processes
2.	Student can be able prepare catalysts and understand the characterization techniques
3.	Student can able to classify, understand the basic principles PTC and can able to carry out various reactions based on the structures
4.	Student can be able to carry out various reactions of PTC and be able to apply in the manufacturing of various industrial products

Unit-I	**Homogeneous Catalysis:** Introduction, Classification of Catalysis, General Features of catalysts, Comparison between Homogeneous and Heterogeneous Catalysis, General Features of Catalysts, Intermediate compound formation theory of Homogeneous catalysis and its Limitations, Characterization of Catalysts, Selectivity, Effective Atomic Number Rule (EAN), Some Industrial Applications of Catalysts.
Unit-II	**Heterogeneous Catalysis:** Introduction, Methods of Preparation of Catalysts, Characterization Techniques, Adsorption Theory of Heterogeneous Catalysis, Kinetics of Heterogeneous Catalysis, Effect of Temperature on Heterogeneous Reactions, Classification of Catalysis, Heterogeneous Catalytic Process used at Industrial Scale.
Unit-III	**Phase Transfer Catalysis:** Introduction, Types of Phase Transfer Catalysts, Principle of Phase Transfer catalysis, Mechanisms of Phase transfer Catalysis, Advantages of Phase Transfer Catalysts, Quaternary ammonium and phosphonium salts, crown ethers, their structures and properties.
Unit-IV	**Industrial Phase transfer Catalytic Processes:** Introduction, Oxidation, Alkylation, Hydrogenation, Dehydrohalogenation, Cynation, Aldol condensation, Some Heterogeneous catalytic processes used at industrial scale, Industrial Applications of Phase Transfer Catalysts.

References:

1. Advanced Physical Chemistry-Gurdeep Raj: Goel publishing House
2. Comprehensive Physical Chemistry-N. B. Singh, N. S. Gajbhiye, Shiva Saran Das: New Age International Publication
3. Wiley Engineering Chemistry Second Edition
4. Principles of Physical Chemistry-Puri, Sharma and Pathania: Vishal Publishing Co.
5. Textbook of Physical Chemistry-P. L. Soni, O. P. Dharmarha and U. N. Dash: Sultan Chand and Sons
6. Physical Chemistry-Dr. S. Parari: New Central Book Agency (p) Ltd.
7. Nanoparticles – Mechanics and Mechanisms – K. T. Ramesh
8. L. Foster, Nanotechnology: Science, Innovation and opportunity, prentice Hall.
9. G. Cao, Nanostructures and Nanomaterials: Synthesis, Properties and Applications – Imperial College Press, London, 2004

M. Sc Semester-III

CHE(P) 505 and 506 PR Physical Chemistry Practical

1. To determine the indicator constant of Phenolphthalein indicator by spectrophotometric method
2. To determine the composition of a binary mixture containing $KMnO_4$ and $K_2Cr_2O_7$ by spectrophotometric method
3. To determine the molecular composition of Ferric-salicylate complex by Job's method.
4. To find the stability constant of Ag-NH_3 complex by potentiometric method.
5. To determine the E^0 and thermodynamic parameters of the Fe^{+2} ions in the given solution.
6. Determination of concentration of H_2SO_4, CH_3COOH and $CuSO_4.5H_2O$ in a given solution by conductometric titration with NaOH.
7. To determine the dissociation constant of copper sulphate by conductometric method.
8. To determine the critical micelles concentration of sodium Laurel sulphate from the measurement of conductivity at different concentrations.
9. To determine the amount of aspirin/ibuprofen in a given tablet by measuring pH of the solution.
10. To determine the ultrasonic velocity and hence the acoustical parameters of pure Liquids.
11. To determine the isentropic Compressibility Ks of given binary mixture.
12. To determine the partial molar volume and the excess volume of binary mixture of ethanol and water.
13. To determine the radius of a molecule by viscosity measurements.
14. To study the reaction between acetone and Iodine.
15. Determination of the Critical Solution Temperature CST of Phenol-Water system.

Reference Books:

1. Practical's in "Physical Chemistry" a Modern Approach
   P S Sindhu: Macmillan India Ltd. ISBN 1403 929165
2. Experiments in Chemistry
   D. V. Jahagirdar: Himalaya Publishing House ISBN 81-7866-679-0

3. Experimental Physical Chemistry
   R C Das, B Behera: Tata McGraw-Hill Publishing Company Limited, ISBN 0-07-451571-3
4. Experimental Physical Chemistry
   V. D. Athawale, Parul Mathur: New Age International Publishers, ISBN 81-224-1336-6
5. Experiments in Physical Chemistry (Instrumental and Physico-Chemical)
   Dr. P. H. Parsania, Dr. FalguniKaria
6. Advanced Practical Physical Chemistry
   J. B. Yadav: Krishna Prakashan Media(P) Ltd., Meerut ISBN 81-8283-916-5
7. A Textbook of Physical Chemistry
   Experimental Aspects in Physical Chemistry Vol. 7 K L Kapoor Mc Graw Hill Education: ISBN-13:978-93-5316-548-2, ISBN-10:93-5316-548-2

SEMESTER – IV (Physical Chemistry)

CHE(P) 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 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.

SEMESTER – IV (Physical Chemistry)

CHE(P) 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 5 (five) days. The sessions must be a minimum of 6 hours per day, in case of seminar/ webinar/ conference/workshop, it is mandatory to participate more than 30 hours in such events. In the 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.

SEMESTER – IV (Physical Chemistry)

CHE(P) 509 Industrial Training and Industry Visit

Guidelines

1 Each student must undergo a minimum of 1-week 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 equipment.

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.

7 The industry tour/visit must be of minimum of two days anywhere in India. The industrial tour certificate will be issued by in charge faculty/Head/Principal, while the visit certificate can be from the industry. Report writing and presentation will be similar to Industrial Training.

CHE(P) 510 Professional Chemistry Test (PCT)

Guidelines for PCT

- Prepare questions from the last five years of CSIR-NET Examinations.
- Preparation should be as per sections A, B, and C from the paper format.
- Examination will be based on MCQ based exam will be conducted.
  (Part A maximum 10 out of 15 questions, Part B maximum 13 out of 20 questions and Part C maximum 6 out of 16 questions. If more than the specified number of questions are answered then the first 10, 13 and 16, respectively will be considered for assessment.)
- No negative marks for wrong answers.

SEMESTER – IV (Physical Chemistry)

CHE(P) 511 Dissertation

Guidelines for Dissertation/Project Work

1. Each student must carry out a project for a minimum duration of 30 days 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 a 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.

SEMESTER – IV (Physical Chemistry)

CHE (P) 511 PR (Lab Course)

1. Determination of pK_{In} of an Indicator using single wavelength by spectrophotometric method.
2. Simultaneous determination of C_o^{II} and C_r^{III} spectrophotometrically.
3. To determine the composition and stability constant of a complex formed between Fe^{III} ions and Salicylic acid by Job's method of continuous variation.
4. To determine the heat of reaction, entropy change and equilibrium constant for the reaction between metallic zinc and copper ions.
5. To find the empirical formula of silver-ammonia complex by potentiometric method.
6. To determine the stability constant of a complex and to evaluate the thermodynamic parameters and to check the effect of solvent and its composition on the stability of the complex by conductometry.
7. To study the complex formation between Fe^{III} with sulfosalicylic acid conductometrically.
8. To determine the Ultrasonic velocity and hence the acoustical parameters of pure liquids.
9. To determine the isentropic compressibility Ks of liquid mixtures.
10. To determine the viscosity and excess viscosity of binary mixtures of ethanol-water.
11. To determine the viscosity and excess Gibbs free energy of activation of flow of the binary mixtures.
12. To determine apparent molar volume and solute-solvent interaction in aqueous glycine at room temperature.
13. To study the effect of impurities on critical solution temperature.
14. To study the kinetics of oxidation of ethanol by potassium dichromate in the acidic medium and to determine the rate constant and energy of activation.
15. To determine the chain linkage in polymer from viscosity measurements.

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