C. U. SHAH UNIVERSITY

C. U. SHAH UNIVERSITY

WADHWAN CITY

FACULTY OF SCIENCES

M.Sc.

CHEMISTRY

SEM - II

Syllabi (CBCS)
WEF Dec 2016

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCES

DEPARTMENT OF CHEMISTRY

COURSE: M.Sc. **SEMESTER: II**

SUBJECT NAME: Inorganic Chemistry-II **SUBJECT CODE: 5SC02ICH1**

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			Total Marks
					Sessional Exam		University Exam		Internal		University	
Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	Pr	TW		
4	0	0	4	4	30	1.5	70	3	--	--	--	100

Objectives:-

- To get the idea about organo metallic compounds there structure, physical and chemical properties.
- To study several various concepts of bonding, their advantages and disadvantages.
- To study the fundamental of bio inorganic chemistry and the importance of metals in biological systems.
- To learn how structures are determined for inorganic molecules using ESR.
- To gain an appreciation for how inorganic chemistry influences your everyday life.

Course outline:-

Sr. No.	Course Contents
1	**Organometallic Compounds:** Introduction, Nature of bonding in organometallic compounds of transition metals. σ-bonded organometallic compounds: Introduction, general characteristics, chemical reactions, bonding and structure. π-bonded organometallic compounds: Introduction and Classification of π-bonded organometallic compounds (a)η2-alkene complexes: Preparative methods, physical properties, chemical properties, bonding of structure. (b) η3allyl (or enyl) complexes preparation, physical of chemical properties.
2	**Fundaments of Bioinorganic Chemistry:** Introduction, Complexes of Ia and IIa group cations in Biological chemistry. Ferredoxin, iron-sulphur proteins and their relevance. Di-nitrogen complexes: their structure, binding and relevance in biology, Biological Nitrogen fixation. Di-oxygen complexes: their structure, binding relevance in biology
3	**Electron spin resonance:** Theory of ESR, ESR applications for the structure determination of metal complexes, Applications of ESR for understanding metal complexes relevant to biology. Interaction between nuclear spin and electron spin.
4	**Ion-Exchangers:** Introduction, classification of ionexchangers and their applications in the separation of following: 1. Zinc and Magnesium, 2. Chloride and bromide, 3. Cobalt and Nickel, 4. Cadmium and Zinc.

Learning Outcomes:-

After the successful completion of the course, students will be able to

- Gain knowledge of organometallic compounds, organo-transitions, chemical reactions, bonding and structure.
- The can be aware about role of inorganic chemistry in biological system.
- Students can get idea about spin resonance and its applications.
- They can learn separation techniques by ion exchangers.

Books Recommended:-

1. Metal ions in Bio-Inorganic Chemistry, P.K. Bhattacharya, Narosa Publishing House.
2. Vogel's Text book of Quantitative Inorganic Analysis, ELBS Press.
3. Organometallic Chemistry, R.C. Mehrotra and A. Singh, New Age International.
4. Advanced Inorganic Chemistry, Cotton Wilkinson, W S E Wiley.
5. Physical Methods in Chemistry, R.S.Drago, Saunders College.
6. The Inorganic Chemistry of Biological Processes, M.N.Hughes, John Wiley & Sons.
7. The Organometallic Chemistry of the Transition Metals, R.H. Crabtree, John Wiley.

8. Metallo-Organic Chemistry, A.J. Pearson, Wiley.

E-Resources:-

1. http://pubs.acs.org/journal/inocaj
2. http://www.chemlin.de/chemistry/inorganic_chemistry.htm
3. http://www.anorg.chem.uu.nl/home/index.html
4. http://www.springer.com/chemistry/inorganic+chemistry/journal/11502
5. http://libguides.stanford.edu/content.php?pid=149720&sid=1271547
6. http://www.science.uwaterloo.ca/~cchieh/cact/applychem/inorganic.html
7. http://pubs.rsc.org/en/journals/journalissues/ic#!recentarticles&all
8. http://www.chem.umass.edu/~samal/orginorgsites.html
9. http://www.sciencedirect.com/science/book/9780123851109
10. http://www.chemistryviews.org/details/event/1442119/2nd_EuCheMS_Inorganic_Chemistry_Conference.html
11. http://store.elsevier.com/Comprehensive-Inorganic-Chemistry-II/isbn-9780080977744/
12. http://chemistry.about.com/cs/generalchemistry/a/aa072103a.htm
13. http://www.ox.ac.uk/admissions/postgraduate_courses/course_guide/chemistry_1.html
14. http://www.researchgate.net/journal/0260-3594_Comments_on_Inorganic_Chemistry
15. http://www.cecam.org/workshop-671.html

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCES

DEPARTMENT OF CHEMISTRY

COURSE: M.Sc. **SEMESTER: II**

SUBJECT NAME: Organic Chemistry-II **SUBJECT CODE: 5SC02OCH1**

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			Total Marks
					Sessional Exam		University Exam		Internal		University	
Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	Pr	TW		
4	0	0	4	4	30	1.5	70	3	--	--	--	100

Objectives:-

- To understand organic chemistry reaction, photochemistry and pericyclic chemistry.
- To learn photo degradation, photo dissociation and various energy states of radiation.
- To learn and understand stereochemistry of organic molecules
- To create interest in students in learning advanced organic chemistry.

Prerequisites:-

Before studying organic chemistry, all students have basic knowledge of inorganic and organic compounds, molecular structure, stereochemistry, isomerism, photochemistry, Molecular orbital theories and knowledge related to UG level chemistry.

Course outline:-

Sr. No.	Course Contents
1.	**Stereochemistry and Chirality:** Concept of Chirality, Chirality and Symmetry, Elements of Chirality including Chiral centre, Chiral axis, Chiral plane and Helicity, Pseudo stereoisomerism, CIP Nomenclature, Molecules with more than one Chiral centre, Total number of Stereoisomer in such molecules, Enantiomeric and Diastereomeric Relationship, Sawhorse, Newman and Fischer Projections, Interconversion of Projections, E-Z Nomenclature, Threo-Erythro Nomenclature, Stereochemistry of Cyclic Compounds, Chiral Compounds without Stereocenters.
2.	**Prochiral Relationships and Asymmetric Synthesis:** Topicity and Pro stereoisomerism, Enantiotopic and Distereotopic Ligands and Faces, Asymmetric Synthesis, Stereoselective and Stereospecific reactions, Sharpless Asymmetric epoxidation.
3.	**Photochemical Reactions:** Introduction, Basic laws of photochemistry, Types of radiations, Fluorescence, Phosphoresces Quantum yield, Joblonski diagram, Strokes shift, Photo-Fries reactions of anilides. Photo-Fries rearrangement. Barton reaction, Norrish type-I and types-II reactions, oxetane formation reaction of the Carbonyl Compounds, Photochemical formation of smog, Photo degradation of polymers. Photochemical reaction of olefins and cis-trans stilbenes. Types of photochemical reaction – photo-dissociation, gas phase photolysis.
4.	**Pericyclic Reaction:** Introduction, types of pericyclic reaction, Antrafacial, suprafacial, in phase, out phase system, Conrotetary and disrotatory motions, molecular orbital theory, FMO, PMO, [2+2] cyclo addition reaction, [4+2] cyclo addition reaction and 1,3,5 hexatriene system, Cyclisation of 4n system, cyclisation of [4n+2] system, Sigmatropic rearrangement, Electrocyclic reaction, Woodward-Hoffmann rules.

Learning Outcomes:-

After the successful completion of the course, students will be able to

- Understand photochemical reactions.
- Determine reaction mechanism, photo chemistry, and pericyclic reactions.
- Understand stereochemistry of molecules

Books Recommended:-

1. A Text Book of Organic Chemistry – R. K. Bansal, New Age International (P) ltd. 4th edition (2003).
2. Advanced Organic Chemistry (IV edition) – Jerry March.
3. Reaction Mechanism and Reagents in Organic Chemistry – Gurdeep R. Chatwal.
4. Organic Chemistry by G. Marc. Loudon, Oxford University Press (2002).
5. Principles of Organic Synthesis by R.O.C Norman, J.M. Coxon, CRC Press, (3rd edition) (2009).
6. Organic Reaction Mechanism (II edition) – V.K. Ahluwalia, R.K. Parasar.
7. Organic Chemistry – I.L.Finar 6th edition (low price), Pearson Education (2003).
8. Organic Chemistry by J. Clayden, N. Greeves, S. Warren, P. Wothers, Oxford University Press (2000).
9. Organic chemistry by P.S. Kalsi
10. Stereochemistry of Organic Compounds principles and applicaions-D. Nasipuri, New Age International.

E-Resources:

1. http://www.organic-chemistry.org/
2. http://www.organicdivision.org/?nd=p_organic_web_links
3. http://www.masterorganicchemistry.com/resource-guide/
4. http://orgchem.iisc.ernet.in/chemlink.html
5. http://www.mpcfaculty.net/ron_rinehart/organic.htm
6. http://web.usca.edu/chemistry/NewStudentInfo/helpful-websites-for-studying-organic-chemistry.dot
7. http://pubs.rsc.org/en/journals/journalissues/oc#!recentarticles&all
8. http://www.chem.ox.ac.uk/vrchemistry/iom/#
9. http://ocw.mit.edu/courses/#chemistry
10. http://www.stolaf.edu/depts/chemistry/courses/toolkits/247/
11. http://iverson.cm.utexas.edu/courses/310M/MainPagesSp06/GoldenRules.html
12. http://www.abdn.ac.uk/curly-arrows/index.html%20(click%20the%20Tutorials%20button)
13. www.wikipedia.org/organic

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FACULTY OF SCIENCES

DEPARTMENT OF CHEMISTRY

COURSE: M.Sc. **SEMESTER: II**

SUBJECT NAME: Physical Chemistry-II **SUBJECT CODE: 5SC02PCH1**

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			Total Marks
					Sessional Exam		University Exam		Internal		University	
Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	Pr	TW		
4	0	0	4	4	30	1.5	70	3	--	--	--	100

Objectives:-

- To know the concepts of polymer chemistry.
- To get the idea about kinetics of polymerization reaction.
- To understand applications of physical chemistry in everyday life.

Prerequisites:-

Before learning Physical chemistry, student should aware about basic principles and theories of physical chemistry, thermodynamics, electrode potential, chemical reactions and other UG level chemistry.

Course outline:-

Sr. No.	Course Contents
1	**Basics of polymer chemistry**: Classification of polymers. Polymer nomenclature. Types of polymer chains. Synthesis of monomers. Stereo regular polymers. Functionality and polymerization concepts.

2	**Chain polymerization:** Kinetics of free radical polymerization and chain transfer reactions. Chain transfer reactions. Factor affecting radical polymerization and properties of the resulting polymer. Free radical polymerization: Methods of initiating free radical polymerization. **Cationic and Anionic polymerization:** Kinetics of cationic and anionic polymerization. Evaluation of reactivity ratios. Coordination polymerization. Molecular weight distribution. Copolymerization and its kinetics. **Free radical polymerization:** Emulsion polymerization Bulk polymerization, solution polymerization, and solid phase polymerization. Poly- recombination. Problems.
3	**Polycondensation**: Kinetics of polycondensation reaction. Molecular weight control in polycondensation. Reaction route of polyfunctional compounds. Nonlinear polycondensation. Statistics of linear polycondensation. Effect of monomer concentration and temperature on direction of polycondensation reaction. Polycondensation equilibrium and molecular weight of polymer. Factors affecting the rate of polycondensation and molecular weight of the polymer. Method of polycondensation: Melt, interfacial, solution and solid phase polycondensation, Problems.
4	**Stepwise polymerization and ring scission polymerization**: Thermodynamics of ring transformation to a linear polymer. Effect of temperature and monomer concentration on ring-polymer equilibrium. Kinetics and mechanism of ring scission polymerization. Effect of activator concentration and temperature on ring scission polymerization and molecular weight of the polymer. Physico-chemical degradation reactions. Cross-linking and reactions of functional groups.

Learning Outcomes:-

After the successful completion of the course, students will be able to

- Understand concept of polymer chemistry, chain polymerization.
- Polymerization and its application.
- Use of polymers in our day today life.

Books Recommended:-

1. Polymer Science, V. R. Gowariker, N. V. Vishwanathan and J. Shreedhar, Willey Eastern Ltd., New Delhi.
2. Organic Polymer Chemistry, K. J. Saundars.
3. Text-book of Polymer Science, F. W. Billmeyer, Willey Interscience.
4. Polymer Chemistry, Bruno Vollmert. Springer, New York.
5. Polymer materials Science, Technology and Developments, Vol.I, SukumarMaity, AnusandhanPrakasan, Midnapore

6. Principles of Polymer Systems, F. Rodriguez, McGraw Hill.
7. A First Course in Polymer Chemistry, Mir Publishers, Moscow.
8. Physical Chemistry of Macromolecules, D. D. Deshpande, IIT, Bombay
9. Polymer Chemistry An Introduction, Malcolm P. Stevens, Addition-Wesley Publishing Company, Inc.
10. Macromolecular Physical Chemistry, P. H. Parsania
11. Principles of Polymer Chemistry, A. Ravve, Kluwer Academic/Plenum Publisher, New York.

E-Resources:-

1. http://ukcatalogue.oup.com/product/9780199543373.do#.UhOsGtI3Bsk
2. http://web.mit.edu/speclab/www/links.html
3. http://library.duke.edu/research/subject/guides/chemistry/
4. http://www.chem.ox.ac.uk/cheminfo/internet.html
5. http://www.science.fau.edu/chemistry/links.htm
6. http://pubs.rsc.org/en/journals/journalissues/cp#!recentarticles&all
7. http://www.rsc.org/ConferencesandEvents/ISACS/PhysicalChemistryandNanoscience/index.asp
8. http://pubs.acs.org/loi/jpchax
9. http://www.csulb.edu/~lhenriqu/chem.htm
10. http://libguides.stanford.edu/content.php?pid=114712&sid=991132
11. http://simple.wikipedia.org/wiki/Physical_chemistry
12. http://chemistry.olivet.edu/chemistry_library.htm
13. http://as.wiley.com/WileyCDA/WileyTitle/productCd-EHEP000800.html
14. http://www.chemsoc.dk/KFlinks.htm
15. http://www.library.auckland.ac.nz/subject-guides/chem/chemmeta.htm
16. http://www.tandfonline.com/toc/trpc20/current#.UhOsT9I3Bsk

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FACULTY OF SCIENCES

DEPARTMENT OF CHEMISTRY

COURSE: M.Sc. **SEMESTER: II**

SUBJECT NAME: Analytical Chemistry-II **SUBJECT CODE: 5SC02ACH1**

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			Total Marks
					Sessional Exam		University Exam		Internal		University	
Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	Pr	TW		
4	0	0	4	4	30	1.5	70	3	--	--	--	100

Objectives:-

- To learn about instrumentations based practical's
- To understand organic synthesis, GLP and laboratory applications.
- Aware about glassware's, sample preparation, reaction mechanism etc

Prerequisites:-

Before learning chemistry practical, student should aware about basic principles and theories of organic and analytical chemistry, instrumental methods, organic synthesis and their analysis and other UG level chemistry.

Course outline:-

Sr. No.	Course Contents
1	**Analytical Objectives, Data Handling and Good Laboratory Practice (GLP)** Scope of analytical science and its literature, qualitative and quantitative analysis, ways to express accuracy and precision, types of errors and their causes; significant figures, control charts, confidence limit, test of significance, rejection of a result- the Q-test. GLP- standard operating procedures, quality assurance and quality control, validation of analytical methods.
2	**Fundamentals of Electrometric Analysis and calculations** **a.** Accuracy and precision **b.** Data processing **c.** Confidence limit and interval **d.** Test of significance **e.** t-test and F-test **f.** Rejection of data **g.** Control charts **h.** Least square analysis
3	**Sampling and Calibration Methods** Sampling and sample preparation, general steps in chemical analysis, calibration of glass wares. Finding the best straight line-least square regression, correlation coefficient; Calibration curves, standard addition technique and internal standards. Chemical concentrations.
4.	**UV-Visible Spectrophotometry:** Principles of UV-Visible Spectrophotometry, theory and applications. Theory of electronic spectroscopy, absorption by organic molecules, choice of solvent and solvent effects. Instrumentation, light source sample preparation.

Learning Outcomes:-

After the successful completion of the course, students will be able to

- Concepts of spectroscopy and its applications.
- Understanding of data analysis, sampling, accuracy and precision etc.
- Understand Principles of UV-Visible Spectrophotometry, theory and applications.

Books Recommended:-

1. Statistics in Chemistry. P. H. Parsanaia
2. W. Horwitz, Official Methods of Analysis, 11th edition (1970), Association of Official Analytical Chemists, Washington DC.
3. Introduction to Spectroscopy**:** Donald L. Pavia, Gary M. Lampman, George S. Kriz Cengage Learning; 4th Edition.
4. Spectroscopic Method in Organic Chemistry**:** Dudley Williams, Ian Fleming McGraw-Hill Education; 6th Edition.
5. Applications of spectroscopic techniques in Organic Chemistry**:** P.S. Kalsi, New Age International; 6th Edition.
6. Analytical Chemistry" by Gary D. Christian, 6th Edition, John Wiley and Sons Inc. New Jersey.

E-Resources:-

1. http://ukcatalogue.oup.com/product/9780199543373.do#.UhOsGtI3Bsk
2. http://web.mit.edu/speclab/www/links.html
3. http://library.duke.edu/research/subject/guides/chemistry/
4. http://www.chem.ox.ac.uk/cheminfo/internet.html
5. http://www.science.fau.edu/chemistry/links.htm
6. http://pubs.rsc.org/en/journals/journalissues/cp#!recentarticles&all
7. http://www.rsc.org/ConferencesandEvents/ISACS/PhysicalChemistryandNanoscience/index.asp
8. http://pubs.acs.org/loi/jpchax
9. http://www.csulb.edu/~lhenriqu/chem.htm
10. http://libguides.stanford.edu/content.php?pid=114712&sid=991132
11. http://simple.wikipedia.org/wiki/Physical_chemistry
12. http://chemistry.olivet.edu/chemistry_library.htm
13. http://as.wiley.com/WileyCDA/WileyTitle/productCd-EHEP000800.html
14. http://www.chemsoc.dk/KFlinks.htm
15. http://www.library.auckland.ac.nz/subject-guides/chem/chemmeta.htm
16. http://www.tandfonline.com/toc/trpc20/current#.UhOsT9I3Bsk

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FACULTY OF SCIENCES

DEPARTMENT OF CHEMISTRY

COURSE: M.Sc. **SEMESTER: II**

SUBJECT NAME: Chemistry Practical - II **SUBJECT CODE: 5SC02PRC1**

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			
					Sessional Exam		University Exam		Internal		University	Total Marks
Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	Pr	TW		
0	0	12	12	6	--	--	--	--	30	20	150	200

Objectives:-

- To learn about physical instrumentations based practical's
- To understand inorganic synthesis of metal complexes.
- Aware about glassware's, sample preparation, etc.

Prerequisites:-

Before learning chemistry practical, student should aware about basic principles and theories of organic and analytical chemistry, instrumental methods, organic synthesis and their analysis and other UG level chemistry.

Course outline:-

Sr. No.	Course Contents
1	**Inorganic Chemistry:** a. **Qualitative Analysis:** Analysis of a mixture containing six radicals, including one rare metal ions: W, Mo, Li etc. b. **Synthesis and estimation of metal complexes:** Synthesis of selected inorganic metal complexes and their estimation by usual volumetric /gravimetric /colorimetric techniques to determine the percentage purity of the complexes prepared:

2	**Physical Chemistry:** **(i) Instrumental exercises:** **a.** Conductometry: Mono and biprotic acids, mixtures of acids against strong/weak bases, argentometric, complexometric, replacement titrations, verification of Onsagar's equation, dissociation of weak acids. **b.** Potentiometry: acid-base, redox and argentometric titrations. **c.** pH metry: acid-base titration, pKa of acids and E0QH2. **d.** Ultrasonics: Acoustical parameters of liquids. **e.** Refractometry: Binary mixtures and solids. **f.** Polarimetry: Optically active compounds. **g.** Spectrophotometry: Lambert-Beers Law, binary mixture, kinetics of iodination, etc. **(ii) Physicochemical exercises**: **a. Reaction dynamics**: Zero, first and second order reactions. **b. Partition coefficient**: Dimerization of acids, I^--I_2 system, Cu^{2+} - NH_3 complexes. **c. Thermodynamics**: Heat of solution, partial molar volume, etc. **d. Steam distillation**: Molecular weight determination.

Reference books

1. Vogel's "Textbook of Quantitative Chemical Analysis"**:** Pearson Education Ltd. 6th Edition, 2008.
2. Vogel's "Qualitative Inorganic Analysis"**:** Pearson Education Ltd. 7th Edition, 2009.
3. Gurdeep Raj, "Advanced Practical Inorganic Chemistry"**:** Krishna Prakashan, Meerut, 21st Edition, 2009.
4. J. B. Yadav, "Advanced Practical Physical Chemistry"**:** Krishna Prakashan, Meerut, 29th Edition, 2010.
5. P. H. Parsania, "Experiments in Physical Chemistry"**:** Neminath Printers Rajkot 1st Edition 2004.
6. M. James and F. E. Prichard, "Practical Physical Chemistry"**:** Longman Group Limited London 3rd Edition Reprinted 1979.