



C. U. SHAH UNIVERSITY



**C. U. SHAH UNIVERSITY
WADHWAN CITY
FACULTY OF SCIENCES**

M.Sc.

**CHEMISTRY
SEM - I**

**Syllabi (CBCS)
WEF June 2016**



FACULTY OF SCIENCES
DEPARTMENT OF CHEMISTRY

COURSE: M.Sc.
SUBJECT NAME: Inorganic Chemistry-I

SEMESTER: I
SUBJECT CODE: 5SC01ICH1

Teaching & Evaluation Scheme:-

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

Objectives:-

- To get an idea about the structure and bonding affects to the physical properties and reactivity of inorganic compounds.
- To be able to understand magnetic properties of inorganic compounds.
- To learn how structures are determined for inorganic molecules and to learn about Mossbauer spectroscopy and its applications.
- To gain the knowledge of basic concepts of Quantum Chemistry and its applications.

Prerequisites:-

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



Course outline:-

Sr. No.	Course Contents
1	Introductions to Quantum Chemistry and its applications: Applications of Quantum Mechanics to simple systems, LCAO-Mo and Valence Bond treatments of H_2 molecule, electron Density, forces and their roles in chemical bonding. Born Oppenheimer approximation, Hybridization and valence MO's of Water, Ammonia and Methane molecule. Huckel π -electron theory and its applications to Ethylene, Butadiene and Benzene. Concept of Self-consistent field method.
2	Basics of Magneto chemistry: Definition, Ferromagnetism, Anti-ferromagnetism, Ferri-magnetisms, Diamagnetism and Pascal's Constant, Russell-Saunders (RS) or LS Coupling, Relations between Multiple width to kT , Stereo chemical applications of Magnetic Properties of the First Transition Series, Lanthanides and actinides, Determination of magnetic susceptibility by Gouy's Method, Derivation of Van Vleck formula for Susceptibility.
3	Mossbauer spectroscopy: Introduction and Schematic Diagram of Mossbauer Spectrophotometer, Principle and Instrumentation of Mossbauer spectra, Applications, Quadrupole splitting. Recoil energy, Doppler effect. Experimental techniques. Chemical Shift.
4	Applications of Inorganic reagents in Inorganic analysis: The uses of some inorganic reagents: Potassium Bromate ($KBrO_3$), Potassium Iodate (KIO_3), Ammonium Vanadate (NH_4VO_3), Ceric Suphate [$Ce(SO_4)_2$], Ethylenediamine Tetra Acetic Acid (EDTA). Uses of Organic reagents in inorganic analysis: Cupferron, DMG, dithiozone, aluminon, oxine, dithiooxamide, a-benzoinoxime, a-nitro-(3-naphthol, a-nitrosoj3naphthol, diphenylcarbazone, diphenylcarbazide, anthranilic acid, tannin, pyragallol, benzidine. salicylaldoxime, o-phenanthroline.

Learning Outcomes:-

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

- Learn basic concepts of quantum chemistry and its applications.
- Understanding of magnetic properties, stereo chemical applications and other theoretical concepts.
- They can get idea of Mössbauer spectroscopy and its experimental techniques.
- Aware about general properties and uses of organic and inorganic reagents in inorganic chemistry.



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Books Recommended:-

1. Introduction to Magnetochemistry, **Alan Earnshaw**, Academic Press.
2. Elements of Magnetochemistry, **Shyamal & Datta** East- West Press.
3. Introduction to Quantum Chemistry, **A K Chandra**, McGraw-Hill.
4. Advanced Inorganic Chemistry, **Cotton Wilkinson**, W S E Wiley.
5. Physical Methods in Chemistry, **R. S. Drago**, Saunders College.
6. Vogel's Text book of Quantitative Inorganic Analysis, ELBS Press.
7. Quantum Chemistry, **Ira N. Levine**, Prentice-Hall International.
8. Textbook of Inorganic Chemistry Vol. I& II, **A. Singh & R. Singh**, Campus.

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.htm
14. http://www.researchgate.net/journal/0260-3594_Comments_on_Inorganic_Chemistry



FACULTY OF SCIENCES

DEPARTMENT OF CHEMISTRY

COURSE: M.Sc.

SEMESTER: I

SUBJECT NAME: Organic Chemistry-I

SUBJECT CODE: 5SC01OCH1

Teaching & Evaluation Scheme:-

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

Objectives:-

- To understand reaction mechanism in organic synthesis.
- To learn theories and principles related to organic chemistry.
- To learn various nucleophilic, substitution and electrophilic reactions in organic chemistry.
- To create an interest of students to learn organic chemistry.

Prerequisites:-

Before studying organic chemistry, all students have basic knowledge of organic and reaction mechanism, molecular structure, rearrangement, catalyst and knowledge related to UG level chemistry.



Course outline:-

Sr. No.	Course Contents
1	Reaction path way and effect of structure on reactivity: Homolytic and Heterolytic fission, different types of arrow notation, Electrophile and Nucleophile, Organic Name Reactions: (I) Nucleophilic C-C bond formation & (II) Electrocyclic C-C bond formation 1. Horner-Wordwoth-Emmons reaction, 2. Mukaiyama reaction 3. Nazarov cyclization, 4. Prins reaction, 5. Vilsmeier- Haack reaction, 6. Noyari reaction 7. Wolff Kishner, 8. Wilgerodt.
2	Organic Coupling reactions: 1. Stille coupling 2. Suzuki coupling 3. Sonogashira coupling 4. Chan-Lam coupling 5. Fukuyama coupling 6. Glaser coupling 7. Hay coupling 8. Hiyama coupling
3	Miscellaneous reactions 1. Barbier-Wieland, 2. Barton reaction, 3. Birch reaction, 4. Bouveault reaction, 5. Clemmensen reduction reaction, 6. Elbs-persulphate reaction, 7. Darzen reaction, 8. Hantzsch reaction, 9. Grubb's reaction, 10. Knoevenagel reaction, 11. Leukart reaction, 12. Michael addition reaction, 13. Mitsunobu reaction, 14. Reformatsky reaction, 15. Appel reaction.
4	Rearrangements & Uses of Selective Reagents: Rearrangements: Reaction mechanism–nature of migration, migratory aptitude, memory effects. A detailed study of the following rearrangements: Baeyer-villiger, 2. Wagner-Meerwein, 3. Demjanov, 4. Neber, 5. Baker Venkatraman 6. Newman-Kwart, Uses of Selective Reagents: 1. Dess Martin Periodinane, 2. Sodium Cyanoborohydride, 3. Lithium diisopropylamide, 4. Crown ethers, 5. Dicyclohexylcarbodiimide, 6. Ceric ammonium nitrate, 7. Wilkinson's catalyst.

Learning Outcomes:-

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

- Organic reaction and mechanism pathways.
- Nucleophilic and electrophilic reaction mechanisms, catalyst and rearrangements reactions.



Books Recommended:-

1. Reaction Mechanism and Problems in Organic Chemistry – P. Chattopadhyay, Asian Book Pvt Ltd, New Delhi (2003).
2. A Text Book of Organic Chemistry – R.K.Bansal, New Age International (P) Ltd. 4th edition (2003).
3. Advanced Organic Chemistry, Part B – F. A. Carey & R. J. Sundberg, Plenum Press (2007).
4. Organic Chemistry by G. Marc. Loudon, Oxford University Press (2002).
5. Organic Reaction Mechanism (II edition) – V.K. Ahluwalia, R.K. Parasar.
6. Reaction Mechanism and Reagents in Organic Chemistry – Gurdeep R. Chatwal.
7. Organic Chemistry by Morrission and Boyd, prentice hall of India pvt ltd (6th edition), (2003)
8. Organic Chemistry – I.L.Finar 6th edition (low price), Pearson Education (2003).
9. Advanced Organic Chemistry (IV edition) – Jerry March.
10. Reactive Intermediates in Organic Chemistry – J.P. Trivedi, University granthNirman Board.
11. Organic Chemistry by T.W. Graham solimn, Craig B. Fryble, low price 8th edition, John Wiley & Sons, inc.
12. Organic Chemistry by V.K.Ahluwalia, MadhuriGoyal, Narosa Publishing House, (2000).
13. Organic Synthesis (2nd edition) by M.B. Smith, Mcgraw-Hill, Inc. (2001).
14. Some Modern Methods of Organic synthesis (4th edition), W.Carruthers, Cambridge University Press (2004).
15. Organic Cehmsitry – Structure and Reactivity by SeyhanEge, A.I.T.B.S. Publishers and Distributors. 3rd edition (1998).
16. Organic Chemistry by J. McMurry, Asian Books Pvt. Ltd., 5th edition (2001). Organic Synthesis – Strategy and Control by Paul Wyatt & Stuart Warren, John Wiley & Sons, (2007).
17. Principles of Organic Synthesis by R.O.C Norman, J.M. Coxon, CRC Press, (3rd edition) (2009).
18. Organic Chemistry by J. Clayden, N. Greeves, S. Warren, P. Wothers, Oxford University Press (2000).
19. Comprehensive Organic Synthesis, Vols 1-9, B.M. Frost & I Fleming. Pergamon (1991).

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>



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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\(click%20the%20Tutorials%20button\)](http://www.abdn.ac.uk/curly-arrows/index.html%20(click%20the%20Tutorials%20button))
13. www.wikipedia.org/organic
14. www.organic-chemistry.org/namedreactions
15. www.name-reaction.com



FACULTY OF SCIENCES

DEPARTMENT OF CHEMISTRY

COURSE: M.Sc.

SEMESTER: I

SUBJECT NAME: Physical Chemistry-I

SUBJECT CODE: 5SC01PCH1

Teaching & Evaluation Scheme:-

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

Objectives:-

- To understand concept and theories of statistical thermodynamics.
- To get idea about fugacity.
- To understand applications of ideal and non-ideal solutions.
- To generate interest and curiosity about physical chemistry.

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 Thermodynamics: Terms of probability, cell, phase space, micro and macro states, thermodynamic probability, statistical weight factor, assembly, ensemble and its classification and statistical equilibrium. Derivation of Boltzmann-Maxwell, Bose-Einstein and Fermi- Dirac statistics, Partition function and derivations of translational, rotational, vibrational and electronic partition functions and thermodynamic functions such as internal energy, heat capacity, entropy, work function, pressure, heat content, etc. Partition function and third law of thermodynamics. Applications of partition function to monoatomic gases, diatomic molecules, equilibrium constant and equilibrium constants of metathetic reactions. Problems.
2	Fugacity and Activity: Definition of Fugacity. Graphical Method. Equation of State Method. Approximate Method. Generalized Method. Variation of Fugacity with Temperature and Pressure. Fugacity of Solids and Liquids. Mixture of Ideal Gases. Mixture of Real Gases. Determinations of Fugacity in Gas Mixtures (The Lewis-Randall Rule). Problems.
3	Types of solutions and their properties: Composition of liquid and vapor in equilibrium influence of temperature on gas solubility and solid-liquid equilibrium. Ideal solutions: Properties, the Duhem Margules equation, vapor pressure curves. Non ideal solutions: General equations for liquid mixtures. Partially miscible liquids. Deviation from ideal behavior, vapor pressure curves, Liquid and vapor compositions. Dilute solutions: Determination of molecular weight by freezing and boiling point methods. Henry's law. Problems.
4	Applications of electrode potentials and thermodynamics of ions in solutions: The dissociation constants of water and weak acids. Free energies of formation of ions. Calculations of equilibrium constants and solubility products from standard potentials. Dissociation pressures. Standard entropies of ions and applications. Standard heats of formation of ions. Examples.

Learning Outcomes:-

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

- Understand Thermodynamics and its applications.
- Concept of fugacity and its determination.
- Understand about solutions, its properties and vapor pressure curves.
- They can be able to apply basics into their experiment as well as their routine life.



Books Recommended:-

1. Thermodynamics for Chemists by **Samuel Glasstone**.
2. Thermodynamics by **Gurdeep and Rajesh**.
3. Statistical Thermodynamics by **L. K. Nash**.

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>



FACULTY OF SCIENCES

DEPARTMENT OF CHEMISTRY

COURSE: M.Sc.

SEMESTER: I

SUBJECT NAME: Analytical Chemistry-I

SUBJECT CODE: 5SC01ACH1

Teaching & Evaluation Scheme:-

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

Objectives:-

- To learn about analytical instrumentation and their applications in analytical chemistry.
- To understand fundamentals of analytical chemistry and its laboratory applications.
- Aware about spectroscopy, food analysis and its various techniques.

Prerequisites:-

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

Course outline:-

Sr. No.	Course Contents
1	Introduction to Analytical Chemistry Definition of analytical chemistry. The role of analytical chemistry, Classification of analytical techniques: classical and instrumental. Fundamentals of Spectrophotometry Properties of light, absorption of light, interaction of light with matter and origin of spectra. The spectrophotometer- calibration, sources of light, monochromators and detectors.



2	Food Analysis: Introduction to food analysis, regulations and international standards related to food analysis, nutritional labeling, sample and sample preparation. C. ompositional analysis of foods for moisture, proteins, fat, fiber, ash, vitamins and minerals. Adulteration of fats and oils; milk and milk products.
3	Fundamentals of quantitative chemical analytical techniques <ol style="list-style-type: none">Sampling of solid liquid and gas.Classical and instrumental techniques with their advantages and disadvantages.Factors affecting the analytical method selection and use.Law of mass action and ionization product of waterFactors affecting chemical reactions in solutionElectrolytic dissociationSolubility product and Common ion effectTheory and applications of precipitation, redox, complexometric and neutralization techniquesVarious concentration units with calculationPreparation, standardization of solutions, reagents, primary and secondary standards.Errors and error minimization
4	<ol style="list-style-type: none">Flamephotometry and atomic absorption spectroscopy: Principle, theory, instrumentation, sample handling and applications.Flourimetry and Phosphorimetry: Principle, Jablonski diagram, instrumentation, sample handling and applications.Turbidimetry and Nephelometry: Principles, theory, instrumentation, sample handling and applications.

Learning outcomes:-

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

- Learn basic analytical techniques and instrumental methods.
- Understand and implement spectroscopic techniques for quantitative analysis.
- Identify and determine food components.

Books Recommended:-

1. Analytical Chemistry. Principles – J. K. Kennedy and W. B. Saunders.
2. Fundamentals of analytical chemistry. D. A. Skoog, D. M. West, F. J. Holler and Crouch.
3. Instrumental Methods of Chemical Analysis. B. K. Sharma.
4. Quantitative Analysis. R. A. Day Jr. And A. L. Underwood.
5. Food Analysis laboratory manual S. Suzanne Nielsen, 3rd edition, Springer 2003
6. Analytical Chemistry.- G. D. Christian.
7. Food Analysis. S. N. Mahindru.



8. Vogel's Textbook of quantitative Inorganic Analysis – L. Barrtet. al. ELBS.

E-Resources:-

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



FACULTY OF SCIENCES
DEPARTMENT OF CHEMISTRY

COURSE: M.Sc.

SEMESTER: I

SUBJECT NAME: Chemistry Practical-I

SUBJECT CODE: 5SC01PRC1

Teaching & Evaluation Scheme:-

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

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	Organic Chemistry: 1. Organic preparation: One & Two stage preparation. Alkylation, nitration, reduction, bromination, halogenation, aminolysis, esterification etc. 2. Organic separation and Identification: Separation of Tartary Mixtures and Identification (i) Solid + Solid + Liquid



	<p>(ii) Solid + Liquid + liquid Mixture should be given Acid-Base, Acid-Phenol, Acid-Neutral, Phenol-Base, Phenol-Neutral, Base-Neutral, and Neutral-Neutral. Water soluble compounds are included. Identification of separated organic compound must be done by physical and chemical tests, sodium fusion test, M.P / B.P., derivatives and crystallization.</p>
	<p>Analytical Chemistry:</p> <ol style="list-style-type: none">Practical's based on food analysis: Honey, oil, tea-leaves, turmeric powder, etc.Drug analysis: aspirin, Benzyl benzoate, etc.Volumetric and gravimetric exercises: Ester, peroxides, other ions, etc.Industrial products: Estimation for purity and assay. <p>Volumetric Analysis:</p> <ol style="list-style-type: none">Estimation of Fe^{3+} by EDTA (Back Titration)Estimation of Bi^{3+} by EDTAEstimation of Chloride by silver nitrate (Mohr's Method)Estimation of Zn^{2+} and Cd^{2+} in a mixture by EDTAEstimation of Ca^{2+} and Mg^{2+} in a mixture by EDTADetermination of percentage purity of H_2O_2 solution by Iodometry method.

Learning outcomes:-

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

- Learn basic analytical techniques and organic synthesis methods.
- Understand qualitative and quantitative analysis of sample.
- Identify and determine organic molecules.

Books Recommended:-

1. A. I. Vogel, "Elementary Practical organic Chemistry Part II, Qualitative Organic Analysis": CBS Publisher, New Delhi
2. A. I. Vogel, "Elementary Practical organic Chemistry Part III, Qualitative Organic Analysis": CBS Publisher, New Delhi
3. Hand book of Organic qualitative analysis by H.T. Clarke.
4. Practical Organic Chemistry: F.G. Mann and B.S. Saunders. ELBS, Longman
5. V.K. Ahuwalla, Sunita Dhingra, "Comprehensive Practical Organic Chemistry-Qualitative analysis": University press (India) Private Limited, Heydrabad
6. J. Leonard, B.Lygo, G.Procter, "Advanced Practical Organic Chemistry" Stanley Thomas Publishers Ltd.
7. R.A. Day, A.L. Underwood, "Quantitative analysis" Prentice-Hall of India Pvt. Ltd., New delhi