

College of Computer, Science & Information Technology - Junagadh

AFFILIATED TO BHAKTA KAVI NARSINH MEHTA UNIVERSITY



◆ Syllabus ◆
Master of Science
in
CHEMISTRY
[Semester – I & II]

Academic Year : 2020 – 21

(Effective from June – 2018)



◀ **ADDRESS : C.C.S.I.T. - JUNAGADH** ▶

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(SEMESTER-I)					
Subject code	Subject Name	Credit	Int. Marks	Ext. Marks	Total Marks
M18CHCC101	Inorganic Chemistry	4	30	70	100
M18CHCC102	Organic Chemistry	4	30	70	100
M18CHCC103	Physical Chemistry	4	30	70	100
M18CHCC104	Analytical Chemistry	4	30	70	100
M18CHCP105	Practical	12	-	100	100
M18CHSC106	Chemoinformatic Tools	2	50	-	50
Total Credits		30	Total Marks		550

(SEMESTER-II)					
Subject code	Subject Name	Credit	Int. Marks	Ext. Marks	Total Marks
M18CHCC201	Inorganic Chemistry	4	30	70	100
M18CHCC202	Organic Chemistry	4	30	70	100
M18CHCC203	Physical Chemistry	4	30	70	100
M18CHCC204	Analytical Chemistry	4	30	70	100
M18CHCC205	Practical	12	-	100	100
M18CHCC206	Research Writing - 1	2	50	-	50
Total Credits		30	Total Marks		550

M.Sc. SEMESTER-I

C-101 : INORGANIC CHEMISTRY

4 CREDITS, 100 MARKS

1. Structure & Bonding

Valance bond theory, Types of overlapping, Molecular orbital theory, Bond order, Factor affecting on Bond length (Bond strength), Homonuclear diatomic molecules, Heteronuclear diatomic molecules, Shapes of covalent compounds, VSEPR, Hybridization, Walsh diagrams, Shapes of molecules having regular & irregular geometry, bent's rule.

2. Chemistry of Main group Elements

General Trends in Main Group Chemistry, Physical Properties, Electronegativity, Ionization Energy, Chemical Properties.

3. Coordination Compounds

Classification of Coordination compounds, Werner's theory, Nomenclature, Isomerism, Coordination number, structures and shapes, electronic spectra (spectroscopic terms, term symbols, calculation of spectroscopic terms).

4. Substitution Reactions in Coordination Complexes

Introduction, Labile and inert complexes, substitution reactions & mechanism in octahedral complexes (Dissociative, Interchange and associative mechanism), Mechanism of ligand, Displacement reactions in square planar complexes, Trans effect, Theories of trans effect, Mechanism of electron transfer reactions – types; outer sphere electron transfer mechanism and inner sphere electron transfer mechanism.

5. Mössbauerspectroscopy

Introduction of Mössbauer Spectroscopy. Principle and evaluation of Mössbauereffect. Recoil energy, Doppler effect. Experimental techniques. Isomer shift, quadrupole splitting and applications.

Reference Books:

1. Miessler, G. L.; Fischer, P. J.; Tarr, D. A. (2014, sixth edition) Inorganic Chemistry. Library of Congress Cataloging-in-Publication Data (ISBN: 978-0-321-81105-9).
2. Agarwala S. K.; Lal K. (2009), Advanced Inorganic Chemistry, Meerut (ISBN: 978-81-8398773-8).
3. Prasad, R. K. (2004, Second edition) Quantum Chemistry. New Delhi: New Age International (P) Ltd. (ISBN: 81-224-1264-5).
4. Chandra, A. K. (2008, Fourth edition) Introductory Quantum Chemistry, New Delhi: Tata McGraw-Hill. (ISBN: 0-07-462054-1).
5. Singh, A.; Singh, R. (2005) Textbook of Inorganic Chemistry Vol. I & II. New Delhi: Campus Books International (ISBN: 8180300714).
6. Mehrotra, R. C. and Singh, A. (2004, Second edition) Organometallic Chemistry A Unified Approach, New Delhi: New Age International (P) Ltd. (ISBN: 81-224-1258-05).

C-102 : ORGANIC CHEMISTRY

4 CREDITS, 100 MARKS

1. Organic reactive intermediates

Inductive effect, Resonance effect, Hyperconjugation effect and its applications (Stability, Acidity, Basicity, Nucleophilicity, Aromatic character), Homolytic and Heterolytic fission, Different types of arrow notation, concept and Examples of Electrophiles and Nucleophiles. Hybridization, Structure, Generation, Stability, Reactivity & Applications of Carbocation, Carbanion, Free radicals, Carbenes, Nitrenes, Ylides, Benzyne and Enamines.

2. Aromaticity

Introduction, Criteria of aromaticity, Hückel's rule, Examples of aromatic, antiaromatic and non-aromatic compounds. Aromatic character for Annulenes, Azulenes & Heterocycles.

3. Organic Reactions

Principal, mechanism and applications of: Appel reaction, Benzoin condensation, Hunsdiecker-Borodin, Nef reaction, Prins reaction, Mitsunobu reaction, Vilsmeier-Haack reaction, Blanc Reaction, Riemer-Tiemann, Michael addition, Dieckmann condensation, Robinson annulations, Arndt-Eistert, Corey-Fuchs alkyne synthesis, Nazarov cyclization.

4. Rearrangements

Principal, mechanism and applications of: Pinacol-pinacolone, Wagner-Meerwein, Demjanov, Benzil-Benzilic acid, Favorskii, Beckmann, Schmidt, Baeyer-Villiger, Lossen rearrangement, Neber rearrangement, Baker-Venkataraman rearrangement

5. Organic Reagents

General mechanism, selectivity, and important applications of the following reagents:

- (a) Oxidative Reagents: $K_2Cr_2O_7/H_2SO_4$ (Jones reagent), CrO_3 -pyridine (Collin's reagent), hypervalent iodine reagents (Dess-Martin), Swern reagent, SeO_2 , HIO_4 , $NaIO_4$
- (b) Metal hydride reduction: Boron reagents ($NaBH_4$, 9-BBN), aluminium reagents ($LiAlH_4$, DIBAL-H), Li/Na-liquid NH_3 mediated reduction (Birch reduction) of aromatic compounds and acetylenes.

Reference Books

1. Ahluwalia, V. K. (2011, Fourth edition) Organic Reaction Mechanism. New Delhi: Narosa (ISBN: 978-81-8487-115-9).

2. J. Clayden, N. Greeves, S. Warren and P. Wothers, Organic Chemistry, 1st Ed., Oxford University Press, 2001.
3. László Kürtip; Barbara Czako (2004, First edition) Strategic Applications of Named Reaction in Organic Synthesis. Philadelphia: Elsevier Publishing company (ISBN: 9780124297852).
4. M.B. Smith & J. March, March's Advanced Organic Chemistry, 6th Ed., John Wiley & Sons, New York, 2007
5. F.A. Carey and R.A. Sundberg, Advanced Organic Chemistry, Part A and Part B, 5th Ed.,
6. McMurry, John E. (2011, Eight edition) Organic Chemistry. Boston: Cengage Learning (ISBN: 0840054440).
7. Smith, Michael B.; March, Jerry (2013, Seventh edition) March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure. Hoboken: Wiley-Blackwell (ISBN: 978-0470-46259-1).
8. Bansal, Raj K. (2009, Fifth) A Textbook of Organic Chemistry. New Delhi: New Age International (ISBN: 978-81-224-2025-8).
9. T. W. Graham Solomons (2011, 10th edition) Organic Chemistry. Hoboken: John Wiley & Sons (ISBN: 978-0-470-55659-7).

C-103 : PHYSICAL CHEMISTRY

4 CREDITS, 100 MARKS

1. Statistical Thermodynamics

The concepts of Ensemble, Thermodynamic probability and entropy, Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics. Partition function, Molar partition function, Thermodynamic properties in term of molecular partition function for diatomic molecules, Monoatomic gases, Rotational, Translational, Vibrational and Electronic partition functions for diatomic molecules, Calculation of equilibrium constants in term of partition function. Monoatomic solids, Theories of specific heat for solids.

2. Fugacity and Activity

Definition, determination of fugacity by graphical, equation of state, approximate and generalized methods. Variation of fugacity with temperature and pressure. Mixture of ideal gases and real gases. Activities and activity coefficients in liquid solution. Problems.

3. The properties of solutions

Ideal Solutions: Properties, the Duhem-Margules equation, vapor pressure curves. Composition of liquid and vapor in equilibrium, influence of temperature on gas solubility and solid-liquid equilibria.

Non ideal Solutions: Deviation from ideal behavior, vapour pressure curves, liquid and vapour compositions. General equations for liquid mixtures, partially miscible liquids

Dilute Solutions: Henry's law. Determination of molecular weights from freezing and boiling points. Problems.

4. Free Energy and Chemical Reactions

Chemical equilibrium and the equilibrium constant: Equilibrium in homogeneous gaseous systems. Homogeneous reactions in liquid solutions. Homogeneous reactions in dilute solutions. Chemical equilibria in heterogeneous systems.

Free energy change in chemical reactions: The reaction isotherm, standard free energy of reaction, the direction of chemical variation of equilibrium constant with pressure and temperature. Influence of temperature on heterogeneous reactions. Integration of the Van't Hoff equation. Variation of standard free energy with temperature. Simultaneous equilibria. Formation of standard free energies and entropy changes and their applications, problems.

5. Homogeneous & Heterogeneous Catalysis

Introduction, types of catalysis (Homogeneous & heterogeneous) & their characteristics. Theory of catalysis, autocatalysis, promoters or activators, types of acid base catalysis. Mechanism of acid-base catalysis & catalytic coefficients, Enzyme catalysis.

Commercial cells: Dry cell, lead accumulator, nickel iron accumulator, zinc silver accumulator.

Reference Books

1. Glasstone, Samuel. (2007) Thermodynamics for Chemists: Narahari Press (ISBN: 1406773220).
2. Peter Atkins, Julio de Paula (2015) Physical chemistry: Thomson Press (ISBN: 019872872-7).
3. Gurdeep Raj (2014, Third edition) Thermodynamics. Meerut: GOEL publishing House (ISBN: 8187224886).
4. Gurtu, J. N. Gurtu, A. (2014, Twelfth edition) Advanced Physical Chemistry. Meerut: Pragati Prakashan (ISBN: 9350060191).
5. Barrow, Gordon M. (1996, Sixth edition) Physical Chemistry. New York: McGraw-Hill International. (ISBN: 0070051119).
6. V R Gowariker, (2012) Polymer Chemistry. New age International P limited. (ISBN: 978-085226-307-5)

C-104: ANALYTICAL CHEMISTRY

4 CREDITS, 100 MARKS

1. Fundamentals of analytical chemistry

Analytical chemistry, its functions and applications, Analytical problems and procedures, Analytical techniques and methods, Sampling and sample handling, Calibration and standards, Quality in analytical laboratories

2. Chemical calculations

Concentration units (Molarities, Normality, Formality, ppb, ppm, mole calculation, Empirical Formulas, % composition, Determination of molecular weight, theoretical yield, Percent Yield, Problems

3. Analytical Methods

Solution equilibria, Electrochemical reactions, Potentiometry, pH and its control, Titrimetry I: acid-base titrations, Complexation, solubility and redox equilibria, Titrimetry II: complexation, precipitation and redox, titrations, Gravimetry, Voltammetry and amperometry, Conductimetry.

4. Environmental Chemistry

Concept and scope of Environmental Chemistry, Terminology and classification of environmental segments, particles, ions and radicals in the atmosphere.

Air pollution: Introduction, major sources of air pollution, air pollutants. Sources of pollutants: gaseous NO_x, SO_x, CO, hydrocarbons, particulates (Inorganic and Organic particulate matters). Effect of pollutants on humans, animals, materials, and vegetation.

Water pollution: Introduction, sources of pollutants, water pollutants, classification of inorganic, organic, thermal and radioactive pollutants

5. Environmental Analysis

(a) **Analysis of air pollutants:** Sampling techniques of gases and particulate, analysis of NO_x, SO_x, CO, H₂S, oxidants and ozone by chromatography and spectrophotometric methods. Analysis of particulates by HVAS techniques.

(b) **Analysis of Water pollution:** Determination of pH, conductivity, TDS, acidity, alkalinity, chloride, iron, sulphate, sulphide, fluoride, ammonia, nitrate, nitrite, calcium, magnesium, DO, BOD, COD, etc.

Reference Books

1. Fundamentals of Analytical Chemistry by Skoog Douglas A. 2. Analytical Chemistry by D. Kealey & P. J. Haines, BIOS Scientific Publishers Limited, 2002 First published 2002 (ISBN 1 85996-189- 4)
3. Instrumental Methods of Analysis by B. Sivasankar 4. B. K. Sharma. "Instrumental method of chemical analysis" 24th edition, GOEL publishing house Meerut .2005
2. H. H. Willard, L. L. Merrit, J. A. Dean, Instrumental Methods of Analysis, 5th Edn. Van Nostrand, 1974 and 6th Edn. CBS (1986).

3. Instrumental Methods of Chemical Analysis by B. K. Sharma, Goel Publishing House, Meerut(UP).
4. H. Kaur, Spectroscopy, 6th Edn. Pragati Prakashan, 2001.
5. Gary D. Christian. " Analytical chemistry" 6th edition John Wiley & sons, Inc. 2004
6. Skoog, Holler, Niemon, "principles of instrumental analysis" 5th edition, Saunders college publisher.
7. Analytical Chemistry by Chatwal G. R.
8. Analytical Chemistry: Theory and Practice by Verma R. M.

M.Sc. SEMESTER-I C-105: PRACTICALS

6 CREDITS, 150 MARKS

INORGANIC CHEMISTRY

1. Inorganic Qualitative Analysis

Analysis of a mixture containing six radicals including one less common metal ion: W, Tl, Ti, Mo, Se, Zr, Th, Ce, V and Li.

ORGANIC CHEMISTRY

1. Qualitative Analysis of Bi-functional organic compounds:

- Anthranilic acid
- p-Aminobenzoic acid
- o-Chlorobenzoic acid
- m-Nitrobenzoic acid
- o/m/p-Nitroaniline
- Bi-phenyl amine
- N,N-Dimethyl aniline
- Resorcinol
- Ethyl acetoacetate
- P-Dichlorobenzene
- o/p-Cresol
- o/m/p-Toluidine
- Benzanilide
- Acetamide
- α/β -Naphthole

NOTE: Other bifunctional compounds may be asked in examination.

2. Qualitative Analysis of Bi-functional Compounds:

- | | |
|------------------------------------|------------------------|
| A. Anthranilic acid | B. p-Aminobenzoic acid |
| C. o-Chlorobenzoic acid | D. m-Nitrobenzoic acid |
| E. o/m/p-Nitroaniline | F. Bi-phenyl amine |
| G. N,N-Dimethyl aniline | H. Resorcinol |
| I. Ethyl acetoacetate | J. P-Dichlorobenzene |
| K. o/p-Cresol | L. o/m/p-Toluidine |
| M. Benzanilide | N. Acetamide |
| O. α/β -Naphthole, etc. | |

NOTE : Other bifunctional compounds may be asked in examination.

PHYSICAL CHEMISTRY

1. **Conductometry:** Mono and biprotic acids, mixtures of acids against strong/weak bases, hydrolysis constant, verification of Onsagar's equation
2. **pH metry:** Quantitative drug analysis, Hemmet constant, hydrolysis constant of electrolytes, acid-base titration, pKa of acids and E0 QH2.
3. **Potentiometry:** Acid-base, normality and dissociation constant, Redox and Argentometric titrations.

4. **Refractometry:** Molar refraction, refractive index, composition of Binary mixtures.

ANALYTICAL CHEMISTRY

1. Preparation and Standardization of solutions.
2. Calibration of glassware and apparatus.
3. To determine the % purity of Aspirin.
4. To determine the % of Zinc Oxide by reduce titration method.
5. To determine the amount of Calcium and Zinc in given sample.
6. To determine the volume strength of H₂O₂.
7. To determine the % purity of given Phthalic anhydride.
8. To determine the % purity of given Malic anhydride.
9. Estimation of Calcium and Magnesium in given sample.
10. To determine amount of iodine in the given iodized salt.

Reference Book:

1. Svehla, G. (1996, Seventh edition) Vogel's Qualitative Inorganic Analysis. New Jersey: Pearson Education. (ISBN: 0582218667).
2. Parsania P. H (2005, 1st edition) Experiments in Physical Chemistry, Granth Nirman Board
3. Brian S. Furniss (1989, Fifth edition) Vogel's Textbook of Practical Organic Chemistry. Hoboken: John Willey & Sons (ISBN: 0-582-462363).
4. Jeffery, G. H.; Bassett, J.; Mendham, J.; Denny, R. C. (1989) Vogel's Textbook of Quantitative Chemical Analysis. Hoboken: John Willey & Sons (ISBN: 0-582-44693-7)

C-106 : CHEMINFORMATIC TOOLS

2 CREDITS, 50 MARKS

1. Chemical Drawing :

Drawing chemical reaction, Structure drawing using templates, Structure to name and name to structure, Drawing mechanism of reaction, Diagram of Assembly, Chiral Structure Draw, Reproducing reaction scheme from given research paper, 3D Chemdraw ultra, energy minimization of given molecule, predicting logP value & other physicochemical parameters

2. Web & Tools for Literature Search : Research Journals & publications

3. Citation & Referencing : Mendeley desktop software



Examination and Evaluation Guidelines

1. The internal exams, assignments are compulsory for the students.

Attendance Guideline

1. It is necessary for the students to remain present during theory and practical during the semester. The presents of the students shall not be less than 80%.
2. Absence even for one lecture or reporting late for the lectures will be marked as absence for whole day.
3. Students may take leave only for genuine reasons after submitting leave application in writing to the class teacher.

Computer Lab Rules

1. Operate the equipment's with care.
2. For any hardware, software problem, please contact lab assistance.
3. Use of internet is strictly prohibited during the lab session.
4. Do not eat or drink in the lab.
5. Do not touch, connect or disconnect any plug or cable without your lecturer/laboratory technician's permission.
6. Keep your bags and shoes outside the lab.
7. Please turn off the computer properly.
8. After allocating the seat to the students. They are not supposed to change without prior permission.
9. Keep the noise level to a minimum.
10. During the lab session, student has to follow the time table and faculties instructions.
11. Students have to be present on time in the lab session and leave the lab after completion the lab or prior permission of the lab faculty.
12. All students have to be presents with ICARD and subject books.
13. The data will be given to the students at their allocated time schedule only.
14. Do not read or modify other user's files. Save your work often.

M.Sc. SEMESTER-II
C-201 : INORGANIC CHEMISTRY

4 CREDITS, 100 MARKS
[12 Hours]

Unit-1 : Magneto Chemistry

Introduction, definition, types of magnetic bodies, Russell-Saunders and LS coupling. Derivation of Russell-Saunders terms, spin-orbit interaction, thermal energy and magnetic property. Magnetic moment for different multiple widths, multiple width large compared to kT , multiple width small compared to kT . Multiple width comparable to kT . Stereo chemical applications of magnetic properties of the first transition series, lanthanides and actinides, determination of magnetic susceptibility by different methods. Derivation of Van Vleck formula for susceptibility.

Unit-2 : Organometallic Complexes

[14 Hours]

Introduction, Structure & Classification, 18 Electron rule, Hapticity, Ligands in organometallic chemistry, Reactions involving gain or loss of ligands, Ligand dissociation and substitution, Oxidative addition and C-H bond activation, Reductive elimination and Pd-Catalyzed cross-coupling, Sigma bond metathesis, Organometallic catalysts, Catalytic deuteration, Hydroformylation, Monsanto acetic acid process, Wacker (Smidt) process, Hydrogenation by Wilkinson's catalyst, Olefin metathesis, Heterogeneous catalysts, Ziegler-Natta polymerizations.

Unit-3 : Bio-Inorganic Chemistry

[12 Hours]

Introduction, classification of elements according to their action in the biological system, deficiency and toxicity, detoxification and chelating agents in medicine, metalloenzymes: classification of biomolecules containing metal ions, metalloporphyrins: introduction, characterization of porphyrins, oxygen carrier and storage, hemoglobin (Hb) and myoglobin (Mb) in oxygen transfer mechanism & functions, biological electron transport proteins: iron-sulfur protein and cytochromes.

Unit-4 : Inorganic Polymers

[12 Hours]

Introduction, general characteristics, structure, preparation, properties and applications of:

- (a) Phosphazenes (PNX_2)_n
- (b) Borazene ($B_3N_3H_6$)
- (c) Silicates
- (d) Silicones

Unit-5 : Inorganic Nanomaterials

[10 Hours]

Introduction, definition of nanomaterials and nano-technology. History of nanomaterials, causes of interest in nanomaterials, properties and types. Synthesis of inorganic nanomaterials, their characterization techniques and applications of nanomaterials.

Reference Books:

1. Miessler, G. L; Fischer, P. J.; Tarr, D. A. (2014, sixth edition) Inorganic Chemistry. Library of Congress Cataloging-in-Publication Data (ISBN: 978-0-321-81105-9).
2. Agarwala S. K.; Lal K. (2009), Advanced Inorganic Chemistry, Meerut (ISBN: 978-81-8398- 773-8).
3. Elements of Magneto Chemistry, Shyamal & Datta East- West Press.
4. Bioinorganic Chemistry, Chatwal and Bhagi, Himaliya Publishing House.
5. Advanced Inorganic Chemistry, Cotton Wilkinson, W S E Wiley.
6. C. N. R. Rao, A. Muller and A. K. Cheetam, (Eds) (2004): The Chemistry of Nanomaterials, Vol.1, and 2, Wiley – VCH, Weinheim.
7. C. P. Poole, and Jr. F. J. Owens, Introduction to Nanotechnology, Wiley Interscience, New Jersey. 2003
8. K. J. Klabunde, Nanoscale materials in Chemistry, Wiley- Interscience, New York, 2001.

C-202 : ORGANIC CHEMISTRY

4 CREDITS, 100 MARKS

[12 Hours]

Unit-1 : Multicomponent Reactions

Principal, mechanism and applications of: Ugi, Biginelli, Mannich reaction, Doebner Quinoline Synthesis, Hantzsch dihydropyridine, Passerini reaction, Bucherer–Bergs reaction.

[12 Hours]

Unit-2 : C-C Bond Forming Reactions

Enolate, Enamine and Imine chemistry, Grignard reagents, Cuprates and other conjugate reactions, Olefination (Wittig, Horner–Wadsworth–Emmons, Julia, and Peterson, Mc-Murry reaction) and Cyclopropanation reaction (Simons-smith), Bayliss Hillman reaction, Organocatalyzed C-C bond forming reactions: Aldol reaction, Mannich reactin and Stork enamine synthesis.

[10 Hours]

Unit-3 : Pd-catalyzed Cross-Coupling Reactions

Introduction, Pd-catalysis, Various ligands, General mechanism of Cross-coupling. Principle, reaction mechanism and application of: Suzuki, Sonogashira, Heck, Negashi, Kumada, Stille, Buchwald-hartwig cross-coupling reactions.

[14 Hours]

Unit-4 : Photochemical Reaction

Absorption of light by organic molecules, Jablonski diagram, properties of excited states, mechanism of excited state processes and methods of preparative photochemistry.

- Photochemistry of alkenes and related compounds: Isomerization, Di- π methane rearrangement and Cycloaddition
- Photochemistry of carbonyl compounds: Norrish type-I cleavage of acyclic, cyclic, and unsaturated carbonyl compounds, Norrish type-II cleavage, Rearrangement of reaction, Photoisomerisation of α,β -unsaturated ketones
- Photocyclo-addition of ketones with unsaturated compounds: Paterno-Buchi reaction, Barton enones and dienones, Photo-Fries rearrangement.

[12 Hours]

Unit-5 : Important Organic Reagents

General mechanism, selectivity, and important applications of the following reagents: TEMPO, NBS, n-Bu₃SnH(TBTH), DDQ, TBAB, DCC, Wilkinson catalyst, Azobisisobutyronitrile(AIBN), Organosilicon reagents (TMSCl, TMSCN, Arylsilanes, Hydrosilation).

Reference Books

- Ahluwalia, V. K. (2011, Fourth edition) Organic Reaction Mechanism. New Delhi: Narosa (ISBN: 978-81-8487-115-9).
- László Kürtip; Barbara Czakó (2004, First edition) Strategic Applications of Named Reaction in Organic Synthesis. Philadelphia: Elsevier Publishing company (ISBN: 9780124297852).
- Organic Chemistry (VI edition) - R.T Morrison- Boyd. Prentice Hall of India (2003)
- Organic Chemistry- (V edition) - John McMurry), Asian Book Pvt Ltd, New Delhi
- Advanced organic chemistry (IV edition) - Jerry March
- Basic stereochemistry of organic molecules by Subrata Sen Gupta, Oxford University press, (ISBN-10:0-19-945163-X)

C-203 : PHYSICAL CHEMISTRY

4 CREDITS, 100 MARKS

[12 Hours]

Unit-1 : Basic Concept of Polymer Chemistry

Polymer introduction, classification, polymer reactions including hydrolysis, acidolysis, aminolysis, hydrogenation, addition and substitution reaction, reaction of various specific groups, Cyclization reaction, cross linking reaction, reactions leading to graft and block copolymers, miscellaneous reactions. Stereo regular polymers. Polymer nomenclature. Functionality and polymerization concept.

Unit-2 : Chain Polymerization**[14 Hours]**

(a) Free Radical Polymerization: Methods of initiating free radical polymerization. Chain transfer reactions. Kinetics of free radical polymerization and chain transfer reactions. Factors affecting radical polymerization and properties of the resulting polymers.

(b) Ionic (Catalytic) Polymerization: Kinetics of cationic and anionic polymerization. Coordination polymerization. Copolymerization and its kinetics. Evaluation of reactivity ratios.

Unit-3 : Polycondensation**[12 Hours]**

Reaction route of poly functional compounds. Kinetics of polycondensation reaction. Molecular weight control in polycondensation. 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.

Unit-4 : Surface Chemistry**[12 Hours]**

Introduction, Adsorption, absorption, sorption, Type of adsorption, Influence of temperature and pressure on adsorption, Langmuir's adsorption isotherm, Adsorption by solid from solution, Electrokinetic (Zeta) potential, Introduction of colloidal state Lyophobic sols and lyophilic sols, Surface active agent OR Surfactants, Micellisation, Critical Micellar Concentration(CMC) .

Unit-5 : Electrochemical cells**[10 Hours]**

Classification, chemical cells with and without transference, concentration cells with and without transference, liquid junction potential.

Decomposition potential, over voltage, hydrogen over voltage, factors affecting over voltage, importance of hydrogen over voltage, numerical problems.

Commercial cells: Dry cell, lead accumulator, nickel iron accumulator, zinc silver accumulator.

Reference Books

1. Textbook of polymer science-third edition by Fred.W. Billmeyer Jr., a Wiley Inter-science publications, ISBN-9971-51-141-X.
2. Polymer Science by V. R. Govariker, New age international publisher, ISBN:978-0-85226-307- 5.
3. Glasstone, Samuel. (2007) Thermodynamics for Chemists: Narahari Press (ISBN: 1406773220).
4. Peter Atkins, Julio de Paula (2015) Physical chemistry: Thomson Press (ISBN: 019872872-7).
5. Gurdeep Raj (2014, Third edition) Thermodynamics. Meerut: GOEL publishing House (ISBN: 8187224886).
6. Gurtu, J. N. Gurtu, A. (2014, Twelfth edition) Advanced Physical Chemistry. Meerut: Pragati Prakashan (ISBN: 9350060191).

C-204: ANALYTICAL CHEMISTRY**4 CREDITS, 100 MARKS****Unit-1 : Analytical Chemometrics****[14 Hours]**

Propagation of measurement of uncertainties, useful statistical tests: Test of significance, F- test, t- test, chisquare-test, correlation coefficient, confidence limit of mean, comparison of mean with true values. Regression analysis (least square method for linear and nonlinear plots). Statistics of sampling and detection limit evaluation. Specific study for analytical method radiation by using validation parameters: (1) accuracy, (2) precision (repeatability and reproducibility), (3) linearity and range, (4) Limit of Detection (LOD) and Limit of quantification (LOQ), (5) selectivity / specificity and (6) Robustness and Ruggedness. Problems.

Unit-2 : Pharmaceutical Analysis**[10 Hours]**

Introduction to Pharmacopeia and Pharmacopeial analysis: Physical and chemical tests: Physical verification and colour test, Loss on drying, loss on ignition, Tare and Bulk Density, Determination of moisture, limit test for heavy metals, Limit test for Halogens, Purity and assay determination by classical methods, Concept for Potency determination. Introduction of Disintegration and Dissolution tests, types of Dissolution apparatus, Types of Dissolution media, Application

Unit-3 : Green Chemistry**[14 Hours]**

Introduction, importance and twelve principles of Green Chemistry. Designing a green synthesis using these principles. Green Chemistry in day to day life. Green solvents (alternatives of organic solvents). Ionic liquids, supercritical fluids, CO₂ and H₂O and aqueous phase organic synthesis.

Non-traditional greener alternative approaches: Green reagents, catalysis, biocatalysis.

Applications of non-conventional energy sources: Microwave, ultrasonic assisted synthesis, electro-synthesis and sunlight (UV), radiation assisted synthesis.

Unit-4 : Intellectual Property Rights**[10 Hours]**

Introduction, various Technical Terms, Legislation, IPA in India, Criteria for Patent, Patent for Polymorph, case studies.

Unit-5 : Analysis of Selected Materials**[12 Hours]**

Principles of estimation of biological fluids. Sampling of biological fluids, Techniques for extraction of drugs from blood and urine, Estimation of hemoglobin, cholesterol and blood sugar (clinical and enzyme assays).

Reference Books

1. Modern Analytical Chemistry by Alka L. Gupta, Pragati Prakashan, 2nd Edition (ISBN:978-93- 5140-571-9)
2. Practical Statistics (Vol 1 and 2) by Singh, Atlantic Publishers.2003.
3. V. K. Ahluwalia, Green Chemistry: Environmentally Benign Reactions. CRC, 2008.
4. Environmental Chemistry by H. Kaur, Pragati Prakashan, Meerut.
5. Environmental Chemistry 7th edition by A.K. De, New Age International Publishers; New Delhi.
6. Spectroscopy 14th edition -2018 by H. Kaur, Pragati Prakashan, Meerut. Environmental Chemistry by V. K. Ahluwalia Ane Books India First Edition. 7. Indian Pharmacopoeia Commission (IPC) Ghaziabad, www.ipc.gov.in

M.Sc. SEMESTER-II
C-205: PRACTICALS**6 CREDITS, 150 MARKS**
[3 Hours]**INORGANIC CHEMISTRY****Inorganic Preparation Binuclear and Mono Nuclear Metal Complexes:**

Preparation of selected inorganic metal complexes:

1. Tetrammine cupric sulphate $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4 \cdot \text{H}_2\text{O}$.
2. Tri (thiourea)cuprous chloride $[\text{Cu}(\text{NH}_2\text{CSNH}_2)_3]\text{Cl}$.
3. Hexa ammine nickel(II) chloride $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$.
4. Hexathiourea-plumbus nitrate $[\text{Pb}(\text{NH}_2\text{CSNH}_2)_6](\text{NO}_3)_2$.
5. Sodium trioxalate ferrate(III) $\text{Na}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]9\text{H}_2\text{O}$.
6. Pentathioureadicuprous nitrate $[\text{Cu}(\text{NH}_2\text{CSNH}_2)_5](\text{NO}_3)_2$.
7. Iron(III) acetylacetonate $\text{Fe}(\text{acac})_3$
8. Copper(II) acetylacetonate $\text{Cu}(\text{acac})_3$

ORGANIC CHEMISTRY**[3 Hours]****Single Step Synthesis:**

1. Phenyl urea from aniline
2. m-diNitro benzene aniline from nitrobenzene.
3. Hydro quinone diacetate from hydroquinone.
4. 1,2,3,4-Tetrahydrocarbazole from Cyclohexanone
5. p-Nitroacetanilide from aniline.
6. 7-Hydroxycoumarine from resorcinol.
7. Hippuric acid from glycine.
8. Benzilic acid from Benzil
9. Phthalamide from phthalic anhydride.
10. Resacetophenone from resorcinol.

PHYSICAL CHEMISTRY**[3 Hours]**

1. **Partition Co-efficient:** Distribution of Benzoic acid in organic solvent & aqueous phase, equilibrium constant by distribution method.
2. **Reaction Kinetics:** First and second order reactions-order determination, energy of activation.
3. **Thermodynamics:** Heat of vaporization, Partial molar volume, etc.
4. **Polarimeter:** concentration of an unknown solution, specific and molecular rotation of glucose/sugar

ANALYTICAL CHEMISTRY**[3 Hours]****Analytical Estimation****Estimation of Drugs by titration**

- % purity of Aspirin, Paracetamol, valproic acid, ascorbic acid etc.

Food Analysis

- Total protein content in milk.
- Peroxide value of oil sample.
- Saponification value of oil sample..
- percentage of starch content in turmeric powder.
- Amount of iodine in the given iodized salt.
- The percentage of reducing sugars in Honey sample.

Reference Book:

1. Svehla, G. (1996, Seventh edition) Vogel's Qualitative Inorganic Analysis. New Jersey: Pearson Education. (ISBN: 0582218667).
2. Parsania P. H (2005, 1st edition) Experiments in Physical Chemistry, Granth Nirman Board
3. Brian S. Furniss (1989, Fifth edition) Vogel's Textbook of Practical Organic Chemistry. Hoboken: John Willey & Sons (ISBN: 0-582-462363).
4. Jeffery, G. H.; Bassett, J.; Mendham, J.; Denny, R. C. (1989) Vogel's Textbook of Quantitative Chemical Analysis. Hoboken: John Willey & Sons (ISBN: 0-582-44693-7).

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