

BHAKTA KAVI NARSINH MEHTA UNIVERSITY

JUNAGADH 362263

SYLLABUS



DEPARTMENT OF CHEMISTRY

M.Sc.- Chemistry

Semester I

Under Choice Based Credit System (CBCS)

Effective from June – 2018

PROGRAM OBJECTIVES:

The curriculum is devised to accomplish the following program objectives which students shall accomplish by the end of their post-graduation study.

- To impart education at advanced level in a more holistic way and to enthuse the students for the subject.
- To provide flexibility in teaching & learning endowed with space for slow & fast learners.
- To update the students about the current status and new developments in the field of Chemistry.
- To train the students to make them confident and capable of accepting new challenges and Job roles in the field of chemistry.
- To expose the students to research in Chemistry and to promote the students for an independent research career.
- To make the students aware of the impact of Chemistry on health & environment and to enable them to imbibe the concept of sustainable development.
- To foster entrepreneurial spirit in the students and to create linkages with various industries/ research centres and others to expose the students to the expectations of the industries & the society.

BHAKTA KAVI NARSINH MEHTA UNIVERSITY

Department of Chemistry

Course Information

M. Sc. SEMESTER -I

Course Type	Course Code	Course Title	Hrs of Instruction / Week	Exam Duration in Hrs.	Component of Marks			Credits
					Internal	External	Total/Passing	
					Total/Passing	Total/Passing	Total/Passing	
Core Courses	M18CHCC101	Inorganic Chemistry	4	3	30/12	70/28	100/40	4
	M18CHCC102	Organic Chemistry	4	3	30/12	70/28	100/40	4
	M18CHCC103	Physical Chemistry	4	3	30/12	70/28	100/40	4
	M18CHCC104	Analytical Chemistry	4	3	30/12	70/28	100/40	4
Practical Courses	M18CHCP105	Practical	12	10	-	100/40	100/40	6
Skill Enhancement Courses (SEC)	M18CHSC106	Chemoinformatic Tools	2	-	50/20	-	50/20	2
Total			30				550	24

SEMESTER-I			
M18CHCC101	Inorganic Chemistry	4 hrs./Wk	4 Credits
SR No.	Course Detail	Inst. Hrs.	
Unit.1	Structure & Bonding Valence 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.	10	
Unit.2	Chemistry of Main group Elements General Trends in Main Group Chemistry, Physical Properties, Electronegativity, Ionization Energy, Chemical Properties.	12	
Unit.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).	12	
Unit.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.	13	
Unit.5	Mössbauerspectroscopy Introduction of Mössbauer Spectroscopy. Principle and evaluation of Mössbauereffect. Recoil energy, Doppler effect. Experimental techniques. Isomer shift, quadrupole splitting and applications.	13	
Reference Books			
<ol style="list-style-type: none"> 1. Miessler, G. L; Fischer, P. J.; Tarr, D. A. (2014, sixth edition) <i>Inorganic Chemistry</i>. Library of Congress Cataloging-in-Publication Data (ISBN: 978-0-321-81105-9). 2. Agarwala S. K.; Lal K. (2009), <i>Advanced Inorganic Chemistry</i>, Meerut (ISBN: 978-81-8398-773-8). 3. Prasad, R. K. (2004, Second edition) <i>Quantum Chemistry</i>. New Delhi: New Age International (P) Ltd. (ISBN: 81-224-1264-5). 4. Chandra, A. K. (2008, Fourth edition) <i>Introductory Quantum Chemistry</i>, New Delhi: Tata McGraw-Hill. (ISBN: 0-07-462054-1). 5. Singh, A.; Singh, R. (2005) <i>Textbook of Inorganic Chemistry Vol. I & II</i>. New Delhi: Campus Books International (ISBN: 8180300714). 6. Mehrotra, R. C. and Singh, A. (2004, Second edition) <i>Organometallic Chemistry A Unified Approach</i>, New Delhi: New Age International (P) Ltd. (ISBN: 81-224-1258-05). 			

SEMESTER-I			
M18CHCC102	Organic Chemistry	4 hrs./Wk	4 Credits
SR No.	Course Detail	Inst. Hrs.	
Unit.1	<p>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.</p>	14	
Unit.2	<p>Aromaticity Introduction, Criteria of aromaticity, Hückel's rule, Examples of aromatic, anti-aromatic and non-aromatic compounds. Aromatic character for Annulenes, Azulenes & Heterocycles.</p>	10	
Unit.3	<p>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.</p>	10	
Unit.4	<p>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</p>	14	
Unit.5	<p>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.</p>	12	
Reference Books			
<ol style="list-style-type: none"> Ahluwalia, V. K. (2011, Fourth edition) <i>Organic Reaction Mechanism</i>. New Delhi: Narosa (ISBN: 978-81-8487-115-9). J. Clayden, N. Greeves, S. Warren and P. Wothers, <i>Organic Chemistry</i>, 1st Ed., Oxford University Press, 2001. László Kürtip; Barbara Czako (2004, First edition) <i>Strategic Applications of Named Reaction in Organic Synthesis</i>. Philadelphia: Elsevier Publishing company (ISBN: 9780124297852). M.B. Smith & J. March, <i>March's Advanced Organic Chemistry</i>, 6thEd., 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: 978-0-470-46259-1).
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).

SEMESTER-I			
M18CHCC103	Physical Chemistry	4 hrs./Wk	4 Credits
SR No.	Course Detail	Inst. Hrs.	
Unit.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.	14	
Unit.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.	10	
Unit.3	The Properties of Solutions Ideal solutions: Properties, the Duhem-Margules equation, vapour pressure curves. Composition of liquid and vapour 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.	12	
Unit.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.	14	
Unit.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.	10	

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: 978-0-85226-307-5).

SEMESTER-I			
M18CHCC104	Analytical Chemistry	4 hrs./Wk	4 Credits
SR No.	Course Detail	Inst. Hrs.	
Unit.1	<p>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</p>	12	
Unit.2	<p>Chemical calculations Concentration units (Molarities, Normality, Formality, ppb, ppm, mole calculation, Empirical Formulas, % composition, Determination of molecular weight, theoretical yield, Percent Yield, Problems</p>	10	
Unit.3	<p>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.</p>	14	
Unit.4	<p>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</p>	12	
Unit.5	<p>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.</p>	12	
Reference Books			
<ol style="list-style-type: none"> 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 			

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.

SEMESTER-I			
M18CHCP105	Practical	12 hrs./Wk	6 Credits
SR. No.	Practical Detail	Lab Hours	
1	Inorganic Chemistry Practicals	3	
	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.		
2	Organic Chemistry Practicals	3	
	Qualitative Analysis of Bi-functional organic compounds: <ul style="list-style-type: none"> • 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.		
3	Physical Chemistry Practicals	3	
	<ol style="list-style-type: none"> 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 $E^0_{QH_2}$. 3. Potentiometry: Acid-base, normality and dissociation constant, Redox and Argentometric titrations. 4. Refractometry: Molar refraction, refractive index, composition of Binary mixtures. 		
4	Analytical Chemistry Practicals	3	
	<ol style="list-style-type: none"> 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 H_2O_2. 		

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| | <ol style="list-style-type: none">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. | |
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Reference Books

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).

SEMESTER-I			
M18CHSC106	Chemoinformatic Tools	2 hrs./Wk	2 Credits
<p>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</p> <p>2. Web & Tools for Literature Search Research Journals & publications</p> <p>3. Citation & Referencing Mendeley desktop software</p>			

Examination Paper style B. Sc. Sem-III to VI & M.Sc. Sem-I
Effective from June - 2018 Subject: Chemistry

Total mark: 70

Time: 2:30 hours

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- Q. 1 (a) Answer the following question. [UNIT-I] (4 Marks)
(1)
- Q. 1 (b) Answer any two questions out of three. [UNIT -I] (10 Marks)
(1)
(2)
(3)
- Q. 2 (a) Answer the following question. [UNIT-II] (4 Marks)
(1)
- Q. 2 (b) Answer any two questions out of three. [UNIT -II] (10 Marks)
(1)
(2)
(3)
- Q. 3 (a) Answer the following question. [UNIT-III] (4 Marks)
(1)
- Q. 3 (b) Answer any two questions out of three. [UNIT -III] (10 Marks)
(1)
(2)
(3)
- Q. 4 (a) Answer the following question. [UNIT-IV] (4 Marks)
(1)
- Q. 4 (b) Answer any two questions out of three. [UNIT-IV] (10 Marks)
(1)
(2)
(3)
- Q. 5 (a) Answer the following question. [UNIT-V] (4 Marks)
(1)
- Q. 5 (b) Answer any two questions out of three. [UNIT-V] (10 Marks)
(1)
(2)
(3)
