

**BHAKTA KAVI NARSINH MEHTA UNIVERSITY**

**JUNAGADH 362263**

## **SYLLABUS**



**DEPARTMENT OF CHEMISTRY AND**

**FORENSIC SCIENCE**

**M.Sc.- Chemistry**

**SEMESTER II**

**Under Choice Based Credit System (CBCS)**

**Effective from June - 2018**

**M.Sc.- Chemistry**  
**Course Framework**  
**M. Sc. SEMESTER -II**

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		
Core Courses	M18CHCC201	Inorganic Chemistry	4	3	30/12	70/28	100/40	4
	M18CHCC202	Organic Chemistry	4	3	30/12	70/28	100/40	4
	M18CHCC203	Physical Chemistry	4	3	30/12	70/28	100/40	4
	M18CHCC204	Analytical Chemistry	4	3	30/12	70/28	100/40	4
Practical Courses	M18CHCP205	Practical	12	10	-	100/40	100/40	6
Skill Enhancement Courses (SEC)	M18CHSC206	Research Writing-I	2	-	50/20	-	50/20	2
<b>Total</b>			<b>30</b>				<b>550</b>	<b>24</b>

<b>SEMESTER-II</b>			
<b>M18CHCC201</b>	<b>Inorganic Chemistry</b>	<b>4 hrs./Wk</b>	<b>4 Credits</b>
<b>SR No.</b>	<b>Course Detail</b>	<b>Inst. Hrs.</b>	
<b>Unit.1</b>	<p><b>Magneto chemistry</b> 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.</p>	<b>12</b>	
<b>Unit.2</b>	<p><b>Organometallic Complexes</b> Introduction, Structure &amp; 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.</p>	<b>14</b>	
<b>Unit.3</b>	<p><b>Bio-Inorganic Chemistry</b> 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 &amp; functions, biological electron transport proteins: iron-sulfur protein and cytochromes.</p>	<b>12</b>	
<b>Unit.4</b>	<p><b>Inorganic Polymers</b> Introduction, general characteristics, structure, preparation, properties and applications of: (a) Phosphazenes (PNX<sub>2</sub>)<sub>n</sub> (b) Borazene (B<sub>3</sub>N<sub>3</sub>H<sub>6</sub>) (c) Silicates (d) Silicones</p>	<b>12</b>	
<b>Unit.5</b>	<p><b>Inorganic Nanomaterials</b> 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.</p>	<b>10</b>	
<b>Reference Books</b>			
<p>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).</p>			

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.

SEMESTER-II			
M18CHCC202	Organic Chemistry	4 hrs./Wk	4 Credits
SR No.	Course Detail	Inst. Hrs.	
Unit.1	<b>Multicomponent Reactions</b> Principal, mechanism and applications of: Ugi, Biginelli, Mannich reaction, Doebner Quinoline Synthesis, Hantzsch dihydropyridine, Passerini reaction, Bucherer–Bergs reaction.	12	
Unit.2	<b>C-C Bond Forming Reactions</b> 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.	12	
Unit.3	<b>Pd-catalyzed Cross-Coupling Reactions</b> 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.	10	
Unit.4	<b>Photochemical Reactions</b> Absorption of light by organic molecules, Jablonski diagram, properties of excited states, mechanism of excited state processes and methods of preparative photochemistry. (a) Photochemistry of alkenes and related compounds: Isomerization, Di- $\pi$ -methane rearrangement and Cycloaddition (b) Photochemistry of carbonyl compounds: Norrish type-I cleavage of acyclic, cyclic, and unsaturated carbonyl compounds, Norrish type-II cleavage (c) Photocyclo-addition of ketones with unsaturated compounds: Paterno-Buchi reaction, Barton reaction, Photodimerisation of $\alpha,\beta$ -unsaturated ketones, Rearrangement of enones and dienones, Photo-Fries rearrangement.	14	
Unit.5	<b>Important Organic Reagents:</b> General mechanism, selectivity, and important applications of the following reagents: TEMPO, NBS, n-Bu <sub>3</sub> SnH(TBTH), DDQ, TBAB, DCC, Wilkinson catalyst, Azobisisobutyronitrile(AIBN), Organosilicon reagents (TMSCl, TMSCN, Arylsilanes, Hydrosilation).	12	
<b>Reference Books</b>			
<ol style="list-style-type: none"> <li>Ahluwalia, V. K. (2011, Fourth edition) <i>Organic Reaction Mechanism</i>. New Delhi: Narosa (ISBN: 978-81-8487-115-9).</li> <li>László Kürtip; Barbara Czako (2004, First edition) <i>Strategic Applications of Named Reaction in</i></li> </ol>			

- Organic Synthesis. Philadelphia: Elsevier Publishing company (ISBN: 9780124297852).
3. Organic Chemistry (VI edition) - R.T Morrison- Boyd. Prentice Hall of India (2003)
  4. Organic Chemistry- (V edition) - John McMurry), Asian Book Pvt Ltd, New Delhi
  5. Advanced organic chemistry (IV edition) - Jerry March
  6. Basic stereochemistry of organic molecules by Subrata Sen Gupta, Oxford University press, (ISBN-10:0-19-945163-X)

SEMESTER-II			
M18CHCC203	Physical Chemistry	4 hrs./Wk	4 Credits
SR No.	Course Detail	Inst. Hrs.	
Unit.1	<p><b>Basic Concept of Polymer Chemistry</b>            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.</p>	12	
Unit.2	<p><b>Chain Polymerization</b>  <b>(a) Free Radical Polymerization:</b> 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>(b) Ionic (Catalytic) Polymerization:</b> Kinetics of cationic and anionic polymerization. Coordination polymerization. Copolymerization and its kinetics. Evaluation of reactivity ratios.</p>	14	
Unit.3	<p><b>Polycondensation</b>            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.</p>	12	
Unit.4	<p><b>Surface Chemistry</b>            Introduction, Adsorption, absorption, sorption, Type of adsorption, Influence of temperature and pressure on adsorption, Langmuirs 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) .</p>	12	
Unit.5	<p><b>Electrochemical cells</b>            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.  <b>Commercial cells:</b> Dry cell, lead accumulator, nickel iron accumulator, zinc silver accumulator.</p>	10	

### Reference Books

1. Textbook of polymer science-third edition by Fred.W. Billmeyer Jr., a Willey 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).

<b>SEMESTER-II</b>			
<b>M18CHCC204</b>	<b>Analytical Chemistry</b>	<b>4 hrs./Wk</b>	<b>4 Credits</b>
<b>SR No.</b>	<b>Course Detail</b>	<b>Inst. Hrs.</b>	
<b>Unit.1</b>	<p><b>Analytical Chemometrics</b>            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.</p>	<b>14</b>	
<b>Unit.2</b>	<p><b>Pharmaceutical analysis</b>            Introduction to Pharmacopeia and Pharmacopeial analysis:            Physical and chemical tests: Physical verification and colour test, Loss on drying, loss on ignition, Tape 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</p>	<b>10</b>	
<b>Unit.3</b>	<p><b>Green Chemistry</b>            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, CO<sub>2</sub> and H<sub>2</sub>O and aqueous phase organic synthesis.  <b>Non-traditional greener alternative approaches:</b> Green reagents, catalysis, biocatalysis.  <b>Applications of non-conventional energy sources:</b> Microwave, ultrasonic assisted synthesis, electro-synthesis and sunlight (UV), radiation assisted synthesis.</p>	<b>14</b>	
<b>Unit.4</b>	<p><b>Intellectual Property Rights (IPR)</b>            Introduction, various Technical Terms, Legislation, IPA in India, Criteria for Patent, Patent for Polymorph, case studies.</p>	<b>10</b>	
<b>Unit.5</b>	<p><b>Analysis of Selected Materials</b>            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).</p>	<b>12</b>	

### 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](http://www.ipc.gov.in)

SEMESTER-II			
M18CHCP205	Practical	12 hrs./Wk	6 Credits
SR. No.	Practical Detail	Lab Hours	
1	<b>Inorganic Chemistry Practicals</b>	<b>3</b>	
	<b>Inorganic Preparation Binuclear and Mono Nuclear Metal Complexes</b> Preparation of selected inorganic metal complexes: <ol style="list-style-type: none"> <li>1. Tetrammine cupric sulphate <math>[\text{Cu}(\text{NH}_3)_4]\text{SO}_4 \cdot \text{H}_2\text{O}</math>.</li> <li>2. Tri (thiourea)cuprous chloride <math>[\text{Cu}(\text{NH}_2\text{CSNH}_2)_3]\text{Cl}</math>.</li> <li>3. Hexa ammine nickel(II) chloride <math>[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2</math>.</li> <li>4. Hexathiourea-plumbus nitrate <math>[\text{Pb}(\text{NH}_2\text{CSNH}_2)_6](\text{NO}_3)_2</math>.</li> <li>5. Sodium trioxalate ferrate(III) <math>\text{Na}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]9\text{H}_2\text{O}</math>.</li> <li>6. Pentathioureadicuprous nitrate <math>[\text{Cu}(\text{NH}_2\text{CSNH}_2)_5](\text{NO}_3)_2</math>.</li> <li>7. Iron(III) acetylacetonate <math>\text{Fe}(\text{acac})_3</math></li> <li>8. Copper(II) acetylacetonate <math>\text{Cu}(\text{acac})_3</math></li> </ol>		
2	<b>Organic Chemistry Practicals</b>	<b>3</b>	
	<b>Single Step Synthesis:</b> <ol style="list-style-type: none"> <li>1. Phenyl urea from aniline</li> <li>2. m-diNitro benzene aniline from nitrobenzene.</li> <li>3. Hydro quinone diacetate from hydroquinone.</li> <li>4. 1,2,3,4-Tetrahydrocarbazole from Cyclohexanone</li> <li>5. p-Nitroacetanilide from aniline.</li> <li>6. 7-Hydroxycoumarine from resorcinol.</li> <li>7. Hippuric acid from glycine.</li> <li>8. Benzilic acid from Benzil</li> <li>9. Phthalamide from phthlic anhydride.</li> <li>10. Resacetophenone from resorcinol.</li> </ol>		
3	<b>Physical Chemistry Practicals</b>	<b>3</b>	
	<ol style="list-style-type: none"> <li>1. <b>Partition Co-efficient:</b> Distribution of Benzoic acid in organic solvent &amp; aqueous phase, equilibrium constant by distribution method.</li> <li>2. <b>Reaction Kinetics:</b> First and second order reactions-order determination, energy of activation.</li> <li>3. <b>Thermodynamics:</b> Heat of vaporization, Partial molar volume, etc.</li> <li>4. <b>Polarimeter:</b> concentration of an unknown solution, specific and molecular rotation of glucose/sugar</li> </ol>		
4	<b>Analytical Chemistry Practicals</b>	<b>3</b>	
	<b>Analytical Estimation</b> <b>Estimation of Drugs by titration</b> <ul style="list-style-type: none"> <li>• % purity of Aspirin, Paracetamol, valproic acid, ascorbic acid etc</li> </ul> <b>Food Analysis</b> <ul style="list-style-type: none"> <li>• Total protein content in milk.</li> <li>• Peroxide value of oil sample.</li> </ul>		

	<ul style="list-style-type: none"> <li>• Saponification value of oil sample..</li> <li>• percentage of starch content in turmeric powder.</li> <li>• Amount of iodine in the given iodized salt.</li> <li>• The percentage of reducing sugars in Honey sample.</li> </ul>	
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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).

<b>SEMESTER-II</b>			
<b>M18CHSC206</b>	<b>Research Writing-I</b>	<b>2 hrs./Wk</b>	<b>2 Credits</b>
	<ul style="list-style-type: none"> <li>• Various journals, data mining</li> <li>• Article formats, various literature search options</li> <li>• Recent publication, citation index</li> <li>• Impact factor</li> <li>• Review article writing preparation</li> </ul>		

# Bhakta Kavi Narsinh Mehta University Junagadh

M.Sc. Chemistry, SEM-2

Question Paper Pattern

(Effective from June 2018)

## Unit-1 [14 marks]

Answer ALL questions

<b>Q.1 (a)</b>	<b>1 Question of 4 Marks OR 2 Questions of 2 Marks Each.</b>	<b>4 Marks</b>
<b>Q.1 (b)</b>	<b>Answer any two question out of three.</b>	<b>10 Marks</b>
(1)		5
(2)		5
(3)		5

## Unit-2 [14 marks]

Answer ALL questions

<b>Q.2 (a)</b>	<b>1 Question of 4 Marks OR 2 Questions of 2 Marks Each.</b>	<b>4 Marks</b>
<b>Q.2 (b)</b>	<b>Answer any two question out of three.</b>	<b>10 Marks</b>
(1)		5
(2)		5
(3)		5

## Unit-3 [14 marks]

Answer ALL questions

<b>Q.3 (a)</b>	<b>1 Question of 4 Marks OR 2 Questions of 2 Marks Each.</b>	<b>4 Marks</b>
<b>Q.3 (b)</b>	<b>Answer any two question out of three.</b>	<b>10 Marks</b>
(1)		5
(2)		5
(3)		5

## Unit-4 [14 marks]

Answer ALL questions

<b>Q.4 (a)</b>	<b>1 Question of 4 Marks OR 2 Questions of 2 Marks Each.</b>	<b>4 Marks</b>
<b>Q.4 (b)</b>	<b>Answer any two question out of three.</b>	<b>10 Marks</b>
(1)		5
(2)		5
(3)		5

**Unit-5 [14 marks]**

Answer **ALL** questions

<b>Q.5 (a)</b>	<b>1 Question of 4 Marks OR 2 Questions of 2 Marks Each.</b>	<b>4 Marks</b>
<b>Q.5 (b)</b>	<b>Answer any two question out of three.</b>	<b>10 Marks</b>
(1)		5
(2)		5
(3)		5

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