

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
JUNAGADH 362263

SYLLABUS



FACULTY OF SCIENCE

Two-Year PG

M.Sc. Chemistry

(Inorganic/Organic/Physical/Analytical Chemistry)

Semester I & II

Syllabus

Under NEP-2020

Effective from June 2026

Program Outcomes (POs): M.Sc. Chemistry with Specialization in Organic / Analytical / Inorganic / Physical Chemistry

PO No.	PO detail
PO ₁	Depth and breadth of knowledge: To produce efficient chemistry graduates with strong fundamental knowledge to cater the global needs related to chemical sciences.
PO ₂	Research and scholarship: To develop research proficiency among graduates for the effective & practical solutions of industrial and societal issues.
PO ₃	Practice and usage of modern technology: To inculcate technical skills in the chemistry graduates towards the use of modern & sophisticated instruments, equipment & cheminformatic tools.
PO ₄	Professional capacity and passion of learning: To empower graduates for skilful utilization of the chemical literature to identify and address various problems by complying with environmental, ethical, and safety aspects.
PO ₅	Moral and aesthetic sustainability: To enrich graduates with contemporary training in professional responsibility, ethics, lifelong learning to secure placement.

Program Specific Outcomes (PSOs): M.Sc. Chemistry with Specialization in Organic / Analytical / Inorganic / Physical Chemistry

PSO No.	PSO Statement
PSO₁	To understand the core chemistry and apply subjective knowledge for the qualitative or quantitative behaviour of compounds.
PSO₂	To demonstrate practical aspects in specialized area comprising Organic/Analytical/Inorganic/Physical chemistry.
PSO₃	To design and perform a broad variety of experiments related to chemistry.
PSO₄	To communicate scientific information orally and in writing.
PSO₅	To acquire ability towards usage of the techniques, skills, and modern tools necessary for chemistry domain.
PSO₆	To comprehend and apply chemical literature for research and effective problem solving.
PSO₇	To create advance skill for the evaluation of experimental results and extend the knowledge to develop competency.
PSO₈	To develop adaptability towards inter & multidisciplinary areas of chemical science.
PSO₉	To apply critical thinking for the environmental issues & sustainable development through chemistry research.
PSO₁₀	To inculcate the ability involving independent and life- long learning in context to societal needs.
PSO₁₁	To empower professional and ethical responsibility.

Bhakta Kavi Narsinh Mehta University
Scheme of Instruction and Examinations
M.Sc. Chemistry (Inorganic/Organic/Physical/Analytical Chemistry)
SEMESTER-I

Sr. No.	Level	SEM	Course Group	Course (Paper) Title	Paper No.	Credit	Teaching Hours/ Week	Internal Marks	External Marks	Practical Internal Marks	Practical External Marks	Total Marks/ Passing
								Total/ Passing	Total /Passing	Total/ Passing	Total/ Passing	
1	PG	1	DSC	Inorganic Chemistry	DSCC-101	4	4	30/12	70/28	--	-	100/40
2	PG	1	DSC	Organic Chemistry	DSCC-102	4	4	30/12	70/28	-	-	100/40
3	PG	1	DSC	Physical Chemistry	DSCC-103	4	4	30/12	70/28	-	-	100/40
4	PG	1	DSC	Analytical Chemistry	DSCC-104	4	4	30/12	70/28	-	-	100/40
5	PG	1	DSC	*Practical & Practical Viva Voce	DSCC-105	4	12	-	-	-	100/40	100/40
6	PG	1	SEC	Chemoinformatic Tools	SECC-101	2	4	-	-	50/20	-	50/20
Total						22	32					550

***Practical of SEM-1 includes Inorganic and Physical Chemistry.**

SEMESTER-I		
Paper No.	Course (Paper) Title	Course Credit & Teaching hrs
DSCC-101	Inorganic Chemistry	4 credits & 4 hrs/week
Course Outcomes: Upon completion of this course, the learner will be able to		
CO No.	CO Statement	
1	Predict bonding & shapes of covalent compounds using MO & VB theories.	
2	Understand and predict the chemical and physical properties of S-block elements.	
3	Classify coordination compounds & predict isomerism, coordination number, shapes and spectral term symbol for coordination compounds.	
4	Explain labile and inert metal complexes with its mechanism.	
5	Outline theoretical and practical aspects of nano materials.	

SEMESTER-I				
DSCC-101		Inorganic Chemistry	4 hrs./Wk	4 Credits
Sr. No.	Course Detail			Inst. Hrs.
Unit.1	Atomic Model & Bonding Atomic Model, Structure & Bonding, Bond Parameters, Molecular orbital theory, Homonuclear diatomic molecules, Heteronuclear diatomic molecules, Valance bond theory, Types of overlapping, Shapes of covalent compounds, VSEPR, Shapes of molecules having regular & irregular geometry, bent's rule.			12
Unit.2	Elements of S-Block Chemistry of Main group Elements of S-Block, General Trends, Physical and Chemical Properties and selected Applications.			10
Unit.3	Coordination Compounds Classification of Coordination compounds, Werner’s theory, Nomenclature, Isomerism, Coordination number, structures, shapes and Hybridisation, electronic spectra, spectroscopic terms, term symbols, calculation of spectroscopic terms.			14
Unit.4	Reaction Mechanism of Coordination Compounds Synthesis and reactions of coordination compounds, Labile and inert complexes, Types of reactions in metal complexes, Substitution in square planar complexes, Substitution reactions & mechanism in octahedral complexes, Trans effect.			12
Unit.5	Nanomaterial Definition and Introduction of nanomaterial, Size effects, Importance of nanomaterials, Classification of nanomaterials, Properties of nanomaterial, Synthesis techniques of nanomaterials, Inorganic Nanoparticles and Nano porous Materials: Oxide, catalysis. Techniques for characterisation of nanoscale materials.			12
Reference Books				
1. Miessler, G. L; Fischer, P. J.; Tarr, D. A.; (2014, sixth edition) Inorganic Chemistry, (ISBN: 978-0-321-81105-9).				

2. Agarwala S. K.; Lal K.; (2009), Advanced Inorganic Chemistry, (ISBN: 978-81-8398-773-8).
3. Singh, A.; Singh, R.; (2005) Textbook of Inorganic Chemistry Vol. I & II. New Delhi: Campus Books International, (ISBN: 8180300714).
4. Housecroft C. E; Sharpe A. G.; (2005, 2nd edition) Inorganic Chemistry, (ISBN: 0130-39913-2).
5. House J. E; House K. A.; (2016, 3rd edition) Descriptive Inorganic Chemistry, (ISBN: 978-0-12-804697-5).
6. Rao C. N. R; Muller A.; Cheetam A. K.; (2004) The Chemistry of Nanomaterials, Vol.1, and 2, Wiley – VCH.
7. Poole C. P.; Owens Jr. F. J.; (2003) Introduction to Nanotechnology Wiley Interscience.
8. Kenneth J. K. (2001) Nanoscale materials in Chemistry, Wiley Interscience.
9. Pradeep T.; (2007) Nano: The Essentials in understanding nanoscience and nanotechnology, Tata McGraw Hill.
10. Ajaikumar; (2016 2nd edition) Organometallic & Bioinorganic Chemistry, Aaryush Education, (ISBN:978-81-930437-1)
11. Strohfeldt K. A., (2015) Essentials of inorganic chemistry: for students of pharmacy, pharmaceutical sciences and medicinal chemistry, (ISBN: 9780470665589)

SEMESTER-I		
Paper No.	Course (Paper) Title	Course Credit & Teaching hrs
DSCC-102	Organic Chemistry	4 credits & 4 hrs/week
Course Outcomes: Upon completion of this course, the learner will be able to		
CO No.	CO Statement	
1	Understand the concept of various electronic effect and its applications.	
2	Calculate aromaticity and differentiate between aromatic, anti-aromatic and non-aromatic compounds.	
3	Understand concept and types of reaction mechanism, draw arrow notation, categorize bond cleavages, and generation of reactive intermediates.	
4	Explain reaction mechanism and identify the reagent for the C-C bond forming reactions.	
5	Illustrate preparation of organic reagents and recognize appropriate reagent for particular reaction.	

SEMESTER-I			
DSCC-102	Organic Chemistry	4 hrs./Wk	4 Credits
Sr. No.	Course Detail	Inst. Hrs.	
Unit.1	Reactive Organic 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. Applications and related reactions Aromaticity Introduction, Criteria of aromaticity, Hückel's rule, Examples of aromatic, anti-aromatic and non-aromatic compounds. Aromatic character for Annulenes, Azulenes & Heterocycles.	14	
Unit.2	Organic Reactions Principal, mechanism and applications of: Appel reaction, Benzoin condensation, 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.	10	
Unit.3	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	10	
Unit.4	Conjugate addition & C-C Bond Forming Reactions Enolate, Enamine and Imine chemistry, Grignard reagents, Cuprates and other conjugate reactions. Olefination reaction: Wittig, Horner-Wadsworth-Emmons, Mc-Murry	14	

	reaction. Cyclopropanation reaction (Simons-smith), Bayliss Hillman reaction, Organocatalyzed C-C bond forming reactions: Aldol reaction, Mannich reaction and Stork enamine synthesis.	
Unit.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. c) (c) TEMPO, NBS, $n-Bu_3SnH(TBTH)$, DDQ, TBAB, DCC, Wilkinson catalyst, Azobisisobutyronitrile (AIBN), Organosilicon reagents ($TMSCl$, $TMSCN$, Arylsilanes, Hydrosilation).	12
Reference Books 1. Ahluwalia, V. K. (2011, Fourth edition) <i>Organic Reaction Mechanism</i>. New Delhi: Narosa (ISBN: 978-81-8487-115-9). 2. J. Clayden, N. Greeves, S. Warren and P. W., <i>Organic Chemistry</i>, 1st Ed., Oxford University Press, 2001. 3. László Kürtip; Barbara Czako (2004, First edition) <i>Strategic Applications of Named Reaction in Organic Synthesis</i>. Philadelphia: Elsevier Publishing company (ISBN: 9780124297852). 4. 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, <i>Advanced Organic Chemistry</i>, Part A and Part B, 5th Ed., 6. McMurry, John E. (2011, Eight edition) <i>Organic Chemistry</i>. Boston: Cengage Learning (ISBN: 0840054440). 7. Smith, Michael B.; March, Jerry (2013, Seventh edition) <i>March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure</i>. Hoboken: Wiley-Blackwell (ISBN: 978-0-470-46259-1). 8. Bansal, Raj K. (2009, Fifth) <i>A Textbook of Organic Chemistry</i>. New Delhi: New Age International (ISBN: 978-81-224-2025-8). 9. T. W. Graham Solomons (2011, 10th edition) <i>Organic Chemistry</i>. Hoboken: John Willey & Sons (ISBN: 978-0-470-55659-7).		

SEMESTER-I		
Paper No.	Course (Paper) Title	Course Credit & Teaching hrs
DSCC-103	Physical Chemistry	4 credits & 4 hrs/week
Course Outcomes: Upon completion of this course, the learner will be able to		
CO No.	CO Statement	
1	Understand thermodynamics of particle by statistical approach, derive and calculate thermodynamic properties of mono and diatomic molecules.	
2	Understand the theories of electrochemical properties with numerical problems.	
3	Justify ideal & non-ideal solutions and determination of properties of solutions.	
4	Distinguish Free energy change and its applications in chemical reactions.	
5	Classify the types, characteristics and mechanism of homogeneous & heterogeneous catalysis.	

SEMESTER-I			
DSCC-103	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. Problems.	14	
Unit.2	Electrochemistry Introduction, Electrolytic solutions, Activity and activity coefficients, electrochemical series, Nernst equation. Ostwald dilution law, Debye-Huckel theory of mean ionic activity co-efficient, Decomposition potential and its determination, over voltage, hydrogen over voltage, factors affecting over voltage, importance of hydrogen over voltage, Tafel equation. Numerical 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, 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	14	

	reactions. Integration of the Van't Hoff equation. Variation of standard free energy with temperature, problems.	
Unit.5	Catalysis • Introduction, Types of catalysis (Homogeneous & heterogeneous), comparison between them, general characteristics of catalytic reaction. • Heterogeneous catalysis: kinetics of unimolecular and bimolecular surface reaction. • Homogeneous catalysis: types of acid base catalysis, Mechanism and kinetics of acid-base catalysis • Enzyme catalysis- Mechanism and kinetics of enzyme catalysed reaction. • Nano catalysis, types, applications.	10

Reference Books

1. Glasstone, Samuel. (2007) Textbook of Physical Chemistry: MCMILAN India Press (SBN: 033391-876-2).
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).
7. Puri, Sharma, Pathamia, (2018, 47th edition) *Principles of Physical Chemistry*. Vishal Publishing Co. (ISBN: 978-93-82956-78-5).
8. B. S. Bahl, Arun Bhahl, G. D. Tuli, (2005) *Essentials of Physical Chemistry*. S. Chand & Company LTP. (ISBN: 81-219-0546-X).
9. *Physical Chemistry*, Ira N Levine (Tata McGraw-Hill Publishing Company, New Delhi, Fifth Edition).
10. *Physical Chemistry*, Alberty and Stilby, (John Wiley & Sons, New York).
11. D.K. Chakrabarty and B. Viswanathan, *Heterogeneous Catalysis*, New Age, 2008.
12. *Introduction to the principles of heterogeneous catalysis*. J.M. Thomas and W.J. Thomas, Acad. press, London, 1967.
13. *Chemical kinetics and catalysis* G.M. Panchenkov and V.P. Lebedev., Mir publication, 1976.

SEMESTER-I		
Paper No.	Course (Paper) Title	Course Credit & Teaching hrs
DSCC-104	Analytical Chemistry	4 credits & 4 hrs/week
Course Outcomes: Upon completion of this course, the learner will be able to		
CO No.	CO Statement	
1	Understand basic concepts of analytical techniques	
2	Apply various traditional analytical methods for chemical analysis.	
3	Identify principles and applications of green chemistry	
4	Discuss optical methods and apply for chemical analysis	
5	Explain thermal methods and apply for thermal analysis	

SEMESTER-I			
DSCC-104	Analytical Chemistry	4 hrs./Wk	4 Credits
Sr. No.	Course Detail	Inst. Hrs.	
Unit.1	Fundamentals of Analytical Chemistry & Chemical Calculations Analytical chemistry, its functions and applications, Analytical problems and procedures, Analytical techniques and methods, Concentration units (Molarities, Normality, Formality, ppb, ppm, mole calculation, Empirical Formulas, % composition, Determination of molecular weight, theoretical yield, Percent Yield, Problems	10	
Unit.2	Analytical Chemometrics Propagation of measurement of uncertainties, useful statistical tests: Test of significance, F- test, t-test, chi-square-test, correlation coefficient, confidence limits 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.	14	
Unit.3	Pharmaceutical Analysis 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.	12	
Unit.4	Green Chemistry 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 ₂ and H ₂ O and aqueous phase organic synthesis. Non-traditional greener alternative approaches: green reagents, catalysis, bio-catalysis. Applications of non-conventional energy sources: Microwave, ultrasonic assisted synthesis, electro-synthesis and sunlight (UV), radiation assisted synthesis.	12	

Unit.5	Intellectual Property Rights (IPR) Introduction, various Technical Terms, Legislation, IPA in India, Criteria for Patent, Patent for Polymorph, case studies.	12
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. Spectroscopy 14th edition -2018 by H. Kaur, Pragati Prakashan, Meerut. Environmental Chemistry by V. K. Ahluwalia Ane Books India First Edition. 5. Indian Pharmacopeia, 2022, 9th Edition, Government of India, Ministry of Health and Welfare, Published by IPC, Ghaziabad. 6. Green Chemistry by V. K. Ahluwalia, Ane Books Pvt. Ltd. 7. Green Chemistry by K. R. Desai, Himalia Publishing House. 8. Instrumental Methods of Analysis by B. Sivasankar 9. Fundamentals of Analytical Chemistry by Skoog Douglas A. 10. Analytical Chemistry by D. Kealey & P. J. Haines, BIOS Scientific Publishers Limited, 2002 First published 2002 (ISBN 1-85996-189- 4) 11. B. Sivasankar, Instrumental Methods of Analysis.		

SEMESTER-I		
Paper No.	Course (Paper) Title	Course Credit & Teaching hrs
DSCC-105	Practical & Practical Viva Voce	4 credits & 12 hrs/week
Course Outcomes: Upon completion of this course, the learner will be able to		
CO No.	CO Statement	
1	Perform qualitative analysis of an inorganic mixture containing six radicals.	
2	Perform inorganic complex synthesis and its characterization.	
3	Utilize Conductivity meter, pH & Potentiometer, Refractometer and Polarimeter for physicochemical analysis.	
4	Perform experiments on Partition Co-efficient, First and second order reactions-order determination, energy of activation, Heat of vaporization.	
5	To examine adsorption isotherms.	

SEMESTER-I			
DSCC-105	Practical & Practical Viva Voce	12 hrs./Wk	4 Credits
Sr. No.	Practical Detail	Lab. Hours	
1	Inorganic Chemistry Practical (40 Marks) Group-A (20 Marks): 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. (Minimum 10 mixtures) Group-B (20 Marks): Preparation and Characterisation of Metal Complexes 1. Preparation and Characterisation of [VO(AcAc) ₂]. 2. Preparation of cis & trans [Cr(Ox) ₂ (H ₂ O)]. 3. Preparation and Characterisation of [Co(Py) ₂ Cl ₂]. 4. Preparation of [Cu(gly) ₂] & [Cu(acac) ₂]. 5. Preparation and Characterisation of [Cu(NH ₃) ₄]SO ₄ .H ₂ O 6. Preparation and Characterisation of [Ni(NH ₃) ₆]Cl ₂ compare with [Ni(H ₂ O) ₆]Cl ₂ . 7. Preparation and Titrimetric Estimation of [Fe(HCO ₂) ₂].2H ₂ O. 8. Preparation and Characterisation of [Ni(en) ₃]Cl ₂ .2H ₂ O 9. Synthesis of bis(salicylidene)ethylene diamine cobalt (II) complex. 10. Synthesis of bis(8-quinolinol) bis(benzylidene)ethane-1,2-diamine Ni(II) complex.	6	
2	Physical Chemistry Practical (40 Marks) Group-A (20 Marks): Conductometry: 1. To determine concentration of mixture HCl+CH ₃ COOH + CuSO ₄ / HCl + Oxalic acid vs. NH ₄ Cl/ NaOH by conductometrically. 2. To determine the equivalent conductance of a strong electrolyte and to verify the Onsager's equation. 3. To determine the degree of hydrolysis and hydrolysis constant. pH metry:	6	

	1. To determine normality and dissociation constant of tribasic acids using 0.1N NaOH by P^H Metrically 2. To determine the Hammett constant for p-amino/ nitro benzoic acid using 0.1N NaOH by P^H-Metry. 3. To determine the standard oxidation potential of the Quinhydrone electrode. 4. Determine the dissociation constant and strength of borax solution p^H metrically. Potentiometry: 1. Determination of dissociation constant of dibasic acids. 2. Determination of activity and activity coefficient of ions. 3. Redox titration- Fe^{2+} vs Ce^{4+}, I^- vs $KMnO_4$. 4. Determine the amount of ferrous sulphate / ferrous ammonium sulphate in given flask potentiometrically using ceric salt solution. 5. Determine the pseudo first order rate constant for bromination of N, N – dimethylaniline/phenol. Refractometry: 1. To study the variation of refractive index with composition of given liquid and to determine the % composition of unknown mixture. 2. Determine parachor/density/refractive index of binary solutions. 3. To determine the molar refractive index of a given salt. 4. To determine the electron polarization and electron polarizability of a given salt. 5. To determine refraction equivalents of carbon, hydrogen and chlorine atoms. Group-B (20 Marks) Partition Co-efficient: 1. To study the distribution of benzoic acid between toluene & water at room temperature and hence to prove the dimerization of benzoic acid in benzene / toluene. 2. To determine equilibrium constant for the reaction between potassium iodide& iodine by the method of distribution. 3. Determine the formula of a complex between Cu^{+2} and NH_3 by distribution method. 4. Determine the equilibrium constant of the reaction $I^- + I_2 = I_3^-$ by the distribution method. 5. To study the distribution co-efficient of succinic acid between ether and water. Reaction Kinetics: 1. To determine the order of the reaction by a fractional change method. 2. To determine the temperature coefficient and the energy of activation of the reaction between $KBrO_3$ and KI. 3. Autocatalytic reaction between $KMnO_4$ and oxalic acid 4. To determine the reaction velocity constant for the reaction between acetone & iodine	
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	5. To determine the temperature coefficient and energy of activation of hydrolysis of methyl acetate catalysed by HCl + KI by fractional change method. Adsorption: 1. To study the adsorption of aqueous oxalic acid solution by activated charcoal and examine the validity of Freundlich and Langmuir's adsorption isotherms. 2. To study the adsorption of I₂ from alcoholic solution by charcoal. Polarimetry: 1. To determine the specific & molecular rotation of glucose/ sucrose & hence intrinsic rotation and concentration of an unknown solution of optically active compound. 2. To determine the rate constant for the inversion of cane sugar. 3. To determine % composition of D-sucrose and tartaric acid in a given mixture. Thermodynamics 1. Heat of vaporization: To determine heat & entropy of vaporization of a given liquid by a kinetic approach.	
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Reference Books

1. Svehla, G. (1996, Seventh edition) Vogel's Qualitative Inorganic Analysis. New Jersey: Pearson Education. (ISBN: 0582218667).
2. Jeffery, G. H.; Bassett, J.; Mendham, J.; Denny, R. C. (1989) Vogel's Textbook of Quantitative Chemical Analysis. Hoboken: John Wiley & Sons (ISBN: 0-582-44693-7).
3. Pass G., Sutcliffe H., (1974 2nd edition) Practical Inorganic Chemistry: Preparations, Reactions, and Instrumental Methods. (ISBN: 9789401727440)
4. Marusak R. A., Doan K., Cummings S. D., (2007) Integrated approach to coordination chemistry an inorganic laboratory guide, (ISBN: 9780471464839)
5. Woollins D. (2006, 2nd edition) Inorganic Experiments, (ISBN: 978352730510)
6. Parsania P. H (2005, 1st edition) Experiments in Physical Chemistry, Granth Nirman Board.
7. Experimental Physical Chemistry by G. Peter Matthews, (Clarendon Press, Oxford, London).
8. Experimental Physical Chemistry by V. D. Athawale and Parul Mathur, (New Age International Publishers, New Delhi).
9. Advanced Physical Chemistry Experiments by Gurtu and Gurtu, (Pragati Prakashan, Meerut).
10. Advanced Physico-Chemical Experiments by J. Rose, (Sir Isaac Pitman & Sons Ltd., London).
11. Experiments in Physical Chemistry by D. P. Shoemaker, C. W. Garland and J. W. Nibler, (McGraw Hill International Edition, London)
12. A Laboratory Manual of Experiments in Physical Chemistry by D. Brennan and C. F. H. Tipper, (McGraw hill Publishing Company Ltd., London).
13. Systematic Experimental Physical Chemistry by S. W. Rajbhoj and T. K. Chondhekar, (Anjali Publication, Aurangabad)
14. Experimental Physical Chemistry by R. C. Das & B. Behera, (Tata McGraw hill Publishing Company Ltd., New Delhi).
15. W. J. Popiel, Laboratory Manual of Physical Chemistry, ELBS, London, 1970

SEMESTER-I		
Paper No.	Course (Paper) Title	Course Credit & Teaching hrs
SECC-101	Chemoinformatic Tools	2 credits & 4 hrs/week
Course Outcomes: Upon completion of this course, the learner will be able to		
CO No.	CO Statement	
1	Draw structures, chemical reaction, mechanism & experimental assemblies.	
2	Identification of various properties via In-silico study.	
3	Use of office tools to interpreted data and results.	
4	Use statistical software for data analysis and graphical representation.	
5	Search & retrieve authenticated scientific reference materials.	

SEMESTER-I			
SECC-101	Chemoinformatic Tools	4 hrs./Wk	2 Credits
1. Chemical Drawing • Usage of Computer Software in Scientific writing and Illustration. • Drawing chemical reactions, Structure drawing using templates, Structure to name and name to structure and deduce various chemical properties. Drawing mechanism of reactions, Diagram of Assembly. • Deduce following from software: Name to structure, Structure to name, Generation of smile, Chemical Formula, Exact Mass, Molecular Weight, Elemental Analysis, Boiling Point, Melting Point, Critical Temp., Critical Pres., Critical Vol., Gibbs Energy, Log P, Predict 1H-NMR and 13C-NMR etc. • Data entry, Statistical Calculations, Graph plotting and regression analysis using MS Excel or equivalent software, creating a spreadsheet, entering and formatting information, applying basic functions and formulae to the data, drawing charts, tables and graphs, displaying the equation of graph along with the R value. • Mean, standard deviation, least square curve fitting method for linear equation. • Scientific Writing and Usage of Office Software. • Plot the conductometric titration curve for a) strong acid vs strong base and b) weak acid vs strong base. Plot the pH metric titration curve for a) strong acid vs strong base and b) weak acid vs strong base and determine the pKa of the weak acid. Plot the graphs for the kinetics of first order reaction and determine the rate constant using MS Excel or equivalent software. • Preparation of scientific poster design and preparation of dissertation presentations with tables and graphs, graphical abstract, various equations, spectral data, etc. with office software. • Preparation of scientific presentations, Poster design and preparation of Seminar presentation using MS Power Point. 2. Web & Tools for Literature Search • Research Journals & publications. 3. Citation & Referencing			

Bhakta Kavi Narsinh Mehta University
Scheme of Instruction and Examinations
M.Sc. Chemistry
SEMESTER-II

Sr. No.	Level	SEM	Course Group	Course (Paper) Title	Paper No.	Credit	Teaching Hours/ Week	Internal Marks	External Marks	Practical Internal Marks	Practical External Marks	Total Marks/ Passing
								Total/ Passing	Total /Passing	Total/ Passing	Total/ Passing	
1	PG	2	DSC	Inorganic Chemistry	DSCC-201	4	4	30/12	70/28	--	-	100/40
2	PG	2	DSC	Organic Chemistry	DSCC-202	4	4	30/12	70/28	-	-	100/40
3	PG	2	DSC	Physical Chemistry	DSCC-203	4	4	30/12	70/28	-	-	100/40
4	PG	2	DSC	Analytical Chemistry	DSCC-204	4	4	30/12	70/28	-	-	100/40
5	PG	2	DSC	* Practical & Practical Viva Voce	DSCC-205	4	12	-	-	-	100/40	100/40
6	PG	2	SEC	Research Writing	SECC-201	2	4	-	-	50/20	-	50/20
Total						22	32					550

***Practical of SEM-2 includes Organic and Analytical chemistry.**

SEMESTER-II		
Paper No.	Course (Paper) Title	Course Credit & Teaching hrs
DSCC-201	Inorganic Chemistry	4 credits & 4 hrs/week
Course Outcomes: Upon completion of this course, the learner will be able to		
CO No.	CO Statement	
1	Classify organometallic compounds using ligands, calculate oxidation state and determine hapticity.	
2	Categorize organometallic reaction mechanism and discuss catalytical cycles.	
3	Understand and predict the chemical and physical properties of boron, carbon and nitrogen family.	
4	Understand and predict the chemical and physical properties of oxygen, halogen and noble gas family.	
5	Discuss the classification and role of metal ions in function of biomolecules.	

SEMESTER-II			
DSCC-201	Inorganic Chemistry	4 hrs./Wk	4 Credits
Sr. No.	Course Detail	Inst. hrs.	
Unit.1	Structure and Bonding in OMC Introduction, Structure & Classification, 18 Electron rule, Hapticity, Ligands in organometallic chemistry: carbonyls, nitrosyls, hydride and dihydrogen, phosphine, ethylene, and related ligands, cyclopentadiene and related ligands, alkyl, aryl, carbenes, carbynes, carbides.	14	
Unit.2	Reaction Mechanism and catalytic process of OMC 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, Tennessee–Eastman acetic anhydride process, Wacker (Smidt) process, Hydrogenation by Wilkinson’s catalyst, Olefin metathesis, Fischer–Tropsch carbon chain growth, Ziegler–Natta polymerizations.	14	
Unit.3	Elements of B, C, and N Family General Trends in Main Group Chemistry, Physical Properties, Electronegativity, Ionization Energy, Chemical Properties. selected Applications.	10	
Unit.4	Elements of O, F, and He Family General Trends in Main Group Chemistry, Physical Properties, Electronegativity, Ionization Energy, Chemical Properties. selected Applications.	10	
Unit.5	Bioinorganic Chemistry Bio-Inorganic Chemistry Introduction, classification of elements according to their action in the biological system, deficiency, and toxicity, metalloenzymes:	12	

	classification of biomolecules containing metal ions, metalloporphyrin: 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	
Reference Books 1. Miessler, G. L; Fischer, P. J.; Tarr, D. A.; (2014, sixth edition) Inorganic Chemistry, (ISBN: 978-0-321-81105-9). 2. Agarwala S. K.; Lal K.; (2009), Advanced Inorganic Chemistry, (ISBN: 978-81-8398-773-8). 3. Singh, A.; Singh, R.; (2005) Textbook of Inorganic Chemistry Vol. I & II. New Delhi: Campus Books International, (ISBN: 8180300714). 4. Housecroft C. E; Sharpe A. G.; (2005, 2nd edition) Inorganic Chemistry, (ISBN: 0130-39913-2). 5. House J. E; House K. A.; (2016, 3rd edition) Descriptive Inorganic Chemistry, (ISBN: 978-0-12-804697-5). 6. Rao C. N. R; Muller A.; Cheetam A. K.; (2004) The Chemistry of Nanomaterials, Vol.1, and 2, Wiley – VCH. 7. Poole C. P.; Owens Jr. F. J.; (2003) Introduction to Nanotechnology Wiley Interscience. 8. Kenneth J. K. (2001) Nanoscale materials in Chemistry, Wiley Interscience. 9. Pradeep T.; (2007) Nano: The Essentials in understanding nanoscience and nanotechnology, Tata McGraw Hill. 10. Ajaikumar; (2016 2nd edition) Organometallic & Bioinorganic Chemistry, Aaryush Education, (ISBN:978-81-930437-1) 11. Strohfeldt K. A., (2015) Essentials of inorganic chemistry: for students of pharmacy, pharmaceutical sciences and medicinal chemistry, (ISBN: 9780470665589)		

SEMESTER-II		
Paper No.	Course (Paper) Title	Course Credit & Teaching hrs
DSCC-202	Organic Chemistry	4 credits & 4 hrs/week
Course Outcomes: Upon completion of this course, the learner will be able to		
CO No.	CO Statement	
1	Understand concept, types and mechanism of multicomponent reaction with applications.	
2	Apply C-C bond forming reactions using Pd- catalysis and Illustrate its mechanism.	
3	Explain concept of organic photochemistry, properties of photochemical reactions and differentiate photo-induced cleavages.	
4	Understand fundamentals of stereochemistry and distinguish types of isomerism and draw stereoisomers in different projections.	
5	Analyse and predict the chemical reactivity of various heterocyclic compounds.	

SEMESTER-II			
DSCC-202	Organic Chemistry	4 hrs./Wk	4 Credits
Sr. No.	Course Detail	Inst. hrs.	
Unit.1	Multicomponent Reactions Principle, mechanism and applications of: Biginelli, Hantzsch dihydropyridine, Mannich reaction, Passerini reaction, Ugi, Malononitrile & 1,3-dicarbonyl based multicomponent reactions (chromenes and pyridine synthesis). 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.	12	
Unit.2	Photochemical Reactions 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- π -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 α,β -unsaturated ketones, Rearrangement of enones and dienones, Photo-Fries rearrangement.	12	
Unit.3	Fundamentals of Stereochemistry Isomerism, tetrahedron geometry and concept of chirality, Isomers, Classification of stereoisomerism, Optical isomerism due to tetrahedron carbon, Wedge-dash and Fisher Projections and their interconversion. Concept of enantiomers, diastereomers and meso compound. Various types of configurational nomenclature of stereocenters (one, two similar and two dissimilar stereocenters). Ring and $\square$ and diastereoisomerism-Variou methods	12	

	of nomenclature for acyclic and cyclic systems-cis-trans, E-Z, syn and anti.	
Unit.4	Heterocyclic chemistry-I a) Nomenclature of heterocyclic compounds b) Heterocyclic analogues of cyclopentane and its fused ring system 1. Preparation and properties of pyrrole, furan, thiophene. 2. Preparation and properties of indole, benzofuran, benzothiophene. c) Heterocyclic analogues of benzene and its fused ring system 1. Preparation and properties of pyridine, quinoline, isoquinoline, acridine. 2. Preparation of benzopyran, benzopyran-2-one and benzopyran-4-one.	14
Unit.5	Heterocyclic chemistry-II a) Compounds with two heteroatoms in a five membered ring 1. Preparation & properties of pyrazole, oxazole, thiazole. 2. Preparation of imidazole, isoxazole, isothiazole. b) Compounds with two heteroatoms in a six membered ring 1. Preparation of pyridazine, pyrimidine, pyrazine, dioxane, Morpholine, phthalazine, quinazoline, quinaxoline, phenothiazine. c) Compounds containing more than two heteroatoms 1. Preparation of triazole, oxadiazole, thiadiazole, triazenes.	10
Reference Books 1. László Kürtip; Barbara Czako (2004, First edition) Strategic Applications of Named Reaction in Organic Synthesis. Philadelphia: Elsevier Publishing company (ISBN: 9780124297852). 2. Kalsi, P. S. (2012, Fourth edition) Organic Reactions Stereochemistry and Mechanism (Through Solved Problems). New Delhi: New Age International (P) Limited. (ISBN: 9788122417661). 3. Organic Chemistry- (V edition) - John McMurry), Asian Book Pvt Ltd, New Delhi 4. Advanced organic chemistry (IV edition), J. March 5. Basic stereochemistry of organic molecules by Subrata Sen Gupta, Oxford University press, (ISBN-10:0-19-945163-X) 6. Ahluwalia, V. K. (2011, Fourth edition) <i>Organic Reaction Mechanism</i> . New Delhi: Narosa (ISBN: 978-81-8487-115-9). 7. Heterocyclic Chemistry by R.K. Bansal, New age international (ISBN-13: 978-8122412123) 8. Heterocyclic chemistry by J.A. Joule, K. Mills (2010, First edition) John Wiley & Sons, Inc., Hoboken, New Jersey, (ISBN 978-1-405-13300-5). 9. Modern Heterocyclic Chemistry by Julio Alvarez-Builla, Juan Jose Vaquero, and Jose' Barluenga, Wiley-VCH publication (ISBN 978-3-527-33201-4) 10. Name reaction in heterocyclic chemistry by J. J. Li, Willey-Interscience (ISBN 0-471-30215-5). 11. The Chemistry of Heterocycles by Theophil Eicher and Siegfried Hauptmann, Wiley-VCH publication (ISBN 3-527-30720-6). 12. Handbook of heterocyclic chemistry by A. R. Katritzky, Pergamon-Elsevier (ISBN 008-0429982)		

SEMESTER-II		
Paper No.	Course (Paper) Title	Course Credit & Teaching hrs
DSCC-203	Physical Chemistry	4 credits & 4 hrs/week
Course Outcomes: Upon completion of this course, the learner will be able to		
CO No.	CO Statement	
1	Outline polymers and explain various polymerization reactions.	
2	Differentiate chain polymerization reactions and calculate polymer properties.	
3	Discuss types of crystals and point defects.	
4	Explain adsorption isotherms and factors affecting it. Discuss properties of colloidal system and factor affecting it.	
5	Describe kinetics of complex reaction of unimolecular and photochemical reactions.	

SEMESTER-II			
DSCC-203	Physical Chemistry	4 hrs./Wk	4 Credits
Sr. No.	Course Detail	Inst. Hrs.	
Unit.1	Polymer Chemistry Introduction, addition and substitution reaction, Cyclization reaction, cross linking reaction, reactions leading to graft and block copolymers, miscellaneous reactions. Stereo regular polymers. Polymer nomenclature. Polycondensation Reaction route of poly functional compounds. Kinetics of polycondensation reaction. Molecular weight control in polycondensation. Statistics of linear polycondensation. Effect of monomer concentration and temperature on direction of polycondensation reaction.	12	
Unit.2	Chain Polymerization (a)Free Radical Polymerization: Methods of initiating free radical polymerization. Chain transfer reactions. Kinetics of free radical polymerization and chain transfer reactions. (b)Ionic (Catalytic) Polymerization: Kinetics of cationic and anionic polymerization. Coordination polymerization. Copolymerization and its kinetics. Evaluation of reactivity ratios. (c)Polymer molecular weight; number average molecular weight, the weight average molecular weight. Problems	12	
Unit.3	Solid state Introduction: symmetry of crystal, miller indices, Types of crystals, molecular, Network covalent, ionic, metallic, band theory, energy band theory of conductors, semiconductors and insulators, imperfections in crystal-point defect, Schottky defect, Frenkel defect, metal excess defect, line defects, quasicrystals.	10	
Unit.4	Surface Chemistry Introduction, Adsorption isotherm: Freundlich, Langmuir, Gibbs and BET of multilayer adsorption, Surface area determination, Electrokinetic (Zeta) potential and its determination by electrophoresis, factor affecting zeta potential. Colloidal state: General properties of colloidal system, Lyophobic sols and	12	

	lyophilic sols, Surface active agent, Micellization: mechanism, Critical Micellar Concentration (CMC) factors affecting the CMC of surfactants.	
Unit.5	Chemical Kinetics: Introduction, activated complex theory in terms of thermodynamic, influence of ionic strength and solvent properties on rate, Complex reactions: Opposing reactions, Consecutive reactions, kinetics of fast reaction, Ionic reactions, and salt effect. Unimolecular reactions: Lindemann-Christiansen hypothesis, Hinshelwood. Photochemical reactions: introduction, rate law, kinetics of photochemical reactions- kinetics of hydrogen-bromine, decomposition of HI.	14

Reference Books

1. Textbook of polymer science-third edition by Fred. W. Billmeyer Jr., a Willey Inter-science publication, 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).
7. Chemical Kinetics, K. J. Laidler, (McGraw Hill Publication).
8. Advanced Practical Physical Chemistry by J. B. Yadav, (Goel Publishing House, Meerut).
9. Chemical Kinetics and Dynamics; Jeffrey I Steinfeld, Joseph S. Francisco and William L. Hase. Prentice Hall, 2nd edition, 1998.
10. Laidler, K. J.; "Chemical Kinetics", 3rd Edition 1997, Benjamin-Cummings. Indian reprint - Pearson 2009.
11. R.G. Frost and Pearson, Kinetics and Mechanism, Wiley, New York, 1961.
12. G.A. Somorjai, Y. Li, Introduction to Surface Chemistry and Catalysis (2n ed.), 2010. Surface Chemistry: Theory and Applications by J.J Bikertman, Academic Press, New York (1972).
13. Physics at surfaces, A Zangwill, Cambridge University Press (1988). 12. Surface crystallography, L J Clarke, Wiley-Interscience (1985).
14. A.W. Adamson, A.P. Gast, Physical chemistry of surfaces, Wiley, 1997.
15. Surface crystallography, L J Clarke, Wiley-Interscience (1985).

SEMESTER-II		
Paper No.	Course (Paper) Title	Course Credit & Teaching hrs
DSCC-204	Analytical Chemistry	4 credits & 4 hrs/week
Course Outcomes: Upon completion of this course, the learner will be able to		
CO No.	CO Statement	
1	Understand the basic and core concept of chromatography.	
2	Understand the principle, instrumentation and applications of liquid and gas chromatography	
3	Illustrate and calculate pharmacopeial analysis based on chromatography and apply for various qualitative and quantitative assessments.	
4	Explain various extraction methods and its applications.	
5	Understand the modern-day applications of hyphenated techniques.	

SEMESTER-II			
DSCC-204	Analytical Chemistry	4 hrs./Wk	4 Credits
Sr. No.	Course Detail	Inst. Hrs.	
Unit.1	Adsorption and Partition Chromatography History, introduction, classification, principles, experimental, factors affecting adsorption & partition chromatography.	12	
Unit.2	Planar Chromatography Principle, basic theory, technique & applications of: Paper chromatography, thin layer chromatography and high-performance thin layer chromatography.	12	
Unit.3	Gas Chromatography Basic theory, instrumentation, working and applications of GC & HS-GC.	12	
Unit.4	Liquid Chromatography Basic theory, instrumentation, working and applications of HPLC & LC-MS.	12	
Unit.5	Extraction Techniques Introduction, types of extraction (LLE, SSE, LSE), extraction methods (maceration, infusion, digestion, decoction, percolation, solvent extraction, soxhlet extraction, counter current extraction, sonication, supercritical fluid extraction, steam distillation) and application.	12	

Reference Books

1. Sethi, P. D. (2013) Sethi HPTLC: High Performance Thin Layer Chromatography: Quantitative Analysis of Pharmaceutical Formulations 3 Volume Set. New Delhi: CBS Publishers & Distributors Pvt. Ltd. (ISBN: 9788123922799).
2. Stahl, E. (1969, Second edition) Thin-Layer Chromatography: A Laboratory Handbook. New Berlin: Springer. (ISBN: 978-3-642-88488-7).
3. Heftmann, E. (2004, Sixth edition) Fundamentals and applications of chromatography and related differential migration methods - Part A (Journal of Chromatography Library). Philadelphia: Elsevier Publishing Company. (ISBN: 0444511075).
4. Skoog, D. A., West D. M., Holler, F. J., Crouch, Stanley R. (2013, Ninth edition) Fundamentals of Analytical Chemistry. Boston: Cengage Learning. (ISBN: 0495558281)
5. Instrumental Methods of Analysis by B. K. Sharma, Goel Publisher, Meerut.

SEMESTER-II		
Paper No.	Course (Paper) Title	Course Credit & Teaching hrs
DSCC-205	Practical & Practical Viva Voce	4 credits & 12 hrs/week
Course Outcomes: Upon completion of this course, the learner will be able to		
CO No.	CO Statement	
1	Perform qualitative analysis of a multifunctional organic compound.	
2	Perform synthesis of organic compounds and demonstrate its mechanism.	
3	Demonstrate and Calibration of glassware & apparatus.	
4	Prepare and standardize the solutions.	
5	Measure the % Assay and % Purity of fine chemicals.	

SEMESTER-II			
DSCC-205	Practical	12 hrs./Wk	4 Credits
Sr. No.	Practical Detail	Lab Hours	
1	Organic Chemistry Practical (50 Marks)	6	
	Group-A: Qualitative Analysis of Bi-functional organic compounds (Minimum 10 Compounds) (20 Marks):		
	• 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. Group-B: Single Step Synthesis (20 Marks): 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 phthlic anhydride. 10. Resacetophenone from resorcinol.	
2	Analytical Chemistry practical (40 Marks)	6
	Group-A: Analytical estimation (20 Marks) 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 the amount of tin from solder wire. Group-B: Analysis of Food and Drug (20 Marks): 1. % purity of Aspirin, Paracetamol, Valproic acid, Ascorbic acid etc. 2. Total protein content in milk. 3. Peroxide value of oil sample. 4. Saponification value of oil sample. 5. Percentage of starch content in turmeric powder. 6. Amount of iodine in the given iodized salt. 7. The percentage of reducing sugars in honey sample.	
Reference Books 1. Brian S. Furniss (1989, Fifth edition) Vogel's Textbook of Practical Organic Chemistry. Hoboken: John Willey & Sons (ISBN: 0-582-462363). 2. Svehla, G. (1996, Seventh edition) <i>Vogel's Qualitative Inorganic Analysis</i>. New Jersey: Pearson Education. (ISBN: 0582218667). 3. Parsania P. H (2005, 1st edition), Experiments in Physical Chemistry, Granth Nirman Board 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-II		
Paper No.	Course (Paper) Title	Course Credit & Teaching hrs
SECC-207	Research Writing	2 credits & 4 hrs/week
Course Outcomes: Upon completion of this course, the learner will be able to		
CO No.	CO Statement	
1	Understand research journal, citations, impact factors and publication processes.	
2	Comprehend literature from research journals.	
3	Prepare review articles using literature survey.	
4	Justify research objective and methodology.	
5	Prepare poster presentation using literature survey.	

SEMESTER-II			
SECC-207	Research Writing	4 hrs./Wk	2 Credits
1. Data Mining and Literature Survey. • Various journals, data mining. • Article formats, various literature search options. • Recent publication, citation index. • Impact factor. • Review article writing preparation and submission in the given format including Title, abstract, introduction, literature survey, summary, references. 2. Design of Ppts., Poster etc. • Preparation of scientific poster design and preparation of dissertation presentations with tables and graphs, graphical abstract, various equations, spectral data, etc. with office software. • Preparation of scientific presentations, Poster design and preparation of Seminar presentation using MS Power Point.			

Bhakta Kavi Narsinh Mehta University Junagadh

M.Sc. Forensic Science SEM-1 and SEM-2

Question Paper Pattern

(Effective from November 2020)

Unit-1 [14 marks]

Answer **ALL** questions

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

Unit-2 [14 marks]

Answer **ALL** questions

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

Unit-3 [14 marks]

Answer **ALL** questions

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

Unit-4 [14 marks]

Answer **ALL** questions

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

Unit-5 [14 marks]

Answer **ALL** questions

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