

Proposed Structure of M. Sc, Syllabus

Semester-II

M. Sc. (Chemistry)

Sr. No.	Course Code	Course Title	L	T/C/S	Credit
1	CHI 201	Inorganic Chem	4		4
2	CHO 202	Organic	4		4
3	CHP 203	Physical	4		4
4	CHA 204	Instrumental and chemical analysis	4		4
5	CHPR 205	Practicals + T/C/S	12	3	6 + 3
			28	3	25

Faculty Code: Science

Subject code:

Level code:

Name of program: M. Sc.

Subject: Chemistry

External Examination Time Duration: 03 hrs

Name of Exam	Semester	Paper No	Course group	Credit	Internal Marks	External Marks	Total Marks
M. Sc.	II	CHI 201	Core	04	30	70	100
		CHO 202	Core	04	30	70	100
		CHP 203	Core	04	30	70	100
		CHA 204	Core	04	30	70	100
		CHPR 205	Practical + T/C/S	06 + 3	60	140	200
			Total	25	180	420	600



VEER NARMAD SOUTH GUJARAT UNIVERSITY M.Sc.-I (CHEMISTRY)

PROPOSED SYLLABUS TO BE EFFECTIVE FROM JUNE 2018

PAPER-I (Inorganic Chemistry)

Max. Marks: 100 (External – 70 + Internal – 30)

Total Periods:

45

UNIT-1 ELEMENTS OF MAGNETOCHEMISTRY:

12

Periods

Definitions of magnetic properties, type of magnetic bodies, the source of paramagnetism, diamagnetism and pascal's constant, Example of pascals constant.

Curie and Curie-Weiss law, Magnetic Properties of transition elements.

Determination of magnetic susceptibility:

(a) Gouy method (b) Faraday method (c) Null deflection method.

Application of magnetic susceptibility measurements, Temperature independent paramagnetism (TIP), Orbital contribution to magnetic moment.

UNIT-II: METAL π -COMPLEXES

11

Periods

Metal carbonyls: Introduction, classification of metal carbonyls, structure and bonding, vibrational spectra studies for bonding and structure elucidation. Preparation of metal carbonyls by (1) Direct synthesis and (2) From metal compounds.

preparation Properties and structure of $\text{Ni}(\text{CO})_4$, $\text{Fe}_2(\text{CO})_9$ and $\text{Co}_2(\text{CO})_8$, 18-electron rule and EAN of metal carbonyls.

Metal Nitrosyls: Introduction, coordination compounds of metal nitrosyls, preparation properties of nitrosyl compounds like nitrosyl halides, nitrosyl cyanides, hydroxides and nitrosyl aquo compounds Complex of NO^+ iron, EAN and structures of nitrosyls.

UNIT-III: Inorganic polymers

11Periods

Definition of polymers and their depiction. Characteristic of inorganic polymer.

Characterization of inorganic polymers (physical properties) by molecular weight, number average and weight average.

Structural features of polymers: (1) Backbone bonding (2) Branching and cross-linking (3) Chemical and stereochemical variability

Classification of inorganic polymer, synthesis, properties, structures uses and application of polyphosphazenes and polysiloxanes.



Periods

Classification of coordination compounds, Werner's theory of coordination,

Electronic interpretation of coordination compounds, Factors effecting the formation of complex ions, Detection of complex ion in solution,

Chelation, Factors influencing the stability of metal chelates, Importance of chelates, Role of metal chelates in living system

Inner complexes and polynuclear complexes, Determination of composition of complex ions.

Reference Book: (For semester –II)

- (1) Magneto chemistry by R. L. Carlin.
- (2) Elements of Magnetochemistry by A. Syamal and R. L. Dutta, Affiliated East-West press, New Delhi, 1993.
- (3) Introduction to metal pi-complex chemistry by M. Tsusui, M. Ichikwa, K. Mori, Plenum press, New York.
- (4) Introductory polymer chemistry by G. S. Mishra, Wiley Eastern Ltd., 1993.
- (5) Phosphorous-Nitrogen Compounds, H. R. Allock, Academic, New York, 1972.
- (6) Advanced in Inorganic Chemistry by S. K. Agarwal, Keemtilal, Pragati prakashan, Meerut.
- (7) Coordination Chemistry by Ajaykumar, Aaryush Education publication, Third publication.
- (8) Principles of inorganic chemistry by Puri, Sharma and Kalia, Vishal publication Co. Jalandhar, Delhi.
- (9) Coordination Chemistry by Gurdeep Chatwal, M. S. Yadav, Himalaya Publishing House.
- (10) Inorganic Polymers by Prof. G. R. Chatwal, Himalaya Publishing House.



M.Sc.Sem. II (Inorganic Practical)

1. Analysis of Solder and Type metal (Alloy Analysis)
2. Determine the amount of Ca^{+2} as $\text{CaC}_2\text{O}_4\text{H}_2\text{O}$ or as CaCO_3 in limestone
3. Estimation of Cu^{+2} as CuSCN .
4. Estimation of Iron in Iron ore.
5. Estimation of available chlorine in bleaching powder.
6. Estimation of Ca^{+2} and Pb^{+2} in Admixture.
7. Determine the amount of Fe^{+3} and Cr^{+3} Present in given Admixture.
8. Determine the percentage purity of the given sample of Manganese salt.
9. Estimation of Aluminium by back titration.

Reference Book:

1. A textbook of practical inorganic chemistry – A.I.Vogel
2. Practical Chemistry by Dr.O.P.Pandey, D.N.Bajpai, Dr.S.Giri
3. Advance inorganic analysis by Agarwal, Keemti lal
4. Qualitative Inorganic analysis – Vogel
5. Inorganic practical by Chatwal and Anand



VEER NARMAD SOUTH GUJARAT UNIVERSITY M.Sc.-I (CHEMISTRY)
PROPOSED SYLLABUS TO BE EFFECTIVE FROM JUNE 2018
PAPER-II (Organic Chemistry)

Max. Marks: 100 (External – 70 + Internal – 30)

Total Periods: 45

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UNIT-I: Organic Name Reactions

12 Periods

General nature, method, mechanism and synthetic applications of the following reactions:

- (i) Heck reaction
- (ii) Dakin reaction
- (iii) Darzen'sglycidic ester synthesis
- (iv) Suzuki reaction
- (v) Willgerodt reaction
- (vi) Buchwald-Hartwig reaction
- (vii) H. V. Z. reaction
- (viii) Mitsunobu reaction
- (ix) Sonagashira reaction
- (x) Dickmann reaction.

UNIT-II: AROMATICITY

11 Periods

- A. Aromaticity and Aromatic character; structure and stability of benzene, Frost circle diagram, concept of aromaticity; Resonance and chemical stabilization; criteria to check aromatic character-IR, NMR, heat of hydrogenation; Huckel's rule; HMO method
- B. Antiaromaticity, homoaromaticity, nonaromaticity; aromaticity in benzenoid compounds: naphthalene, pyrene, acepleialdelene.
- C. Aromaticity non-benzenoid compounds: azulene, tropolones, charged rings, annulenes, fullerenes, and mesoionic compounds.

UNIT-III: ORGANIC TRANSFORMATION AND REAGENTS

11 Periods

- I. Sharplesseoxidation
- II. Umpolung reagent (1,3-dithiane)
- III. Dess martin periodinane
- IV. DDQ
- V. Tri-n-butyltinhydride (C₄H₉)₃SnH
- VI. Diisobutyl aluminum hydride (DIDAL-H)
- VII. Lithium disoprrpyl amide (LDA)
- VIII. OZONE
- IX. Crown ethers
- X. Wilkinson's Catalyst



UNIT-IV:**11 Periods****PHOTO CHEMISTRY**

- A. Energy of molecules, photochemical energy, electronic excitation, Jablonski diagram, laws of photochemistry, quantum efficiency.
- B. Photochemistry of carbonyl compounds- α - cleavage of acyclic, cyclic and α - β unsaturated cleavage of carbonyl compounds, β - cleavage of, inter and intramolecular hydrogen abstraction, addition to carbon- carbon double bond, photo reduction of carbonyl compounds.
- C. Photo induce rearrangement of enones, dienones and alkenes. Photochemistry of alkenes and aromatic compounds- isomerization, dimerization and addition reactions.

Reference book:

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Reaction Mechanism in Organic Chemistry by S. M. Mukherji and S. P. Singh (McMillan India Ltd., 1976).
3. Organic Chemistry (3/e) by J. B. Hendrickson, Donald J. Cram and George S. Hammond (McGraw-Hill Book Co. & Kogekusha Co. Ltd., 1970).
4. Organic Chemistry (5/e) by Morrison & Boyd (Prentice Hall).
5. Advanced Organic Chemistry by Carey & Sundberg (3rd edition).
6. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
7. Name Reactions by A. R. Parikh & H.A. Parikh
8. Name reaction: A collection of detailed reaction mechanism by Jie Jack Li
9. Reaction Mechanism and Reagents in Organic Chemistry by C. R. Chatwal (Himalaya Publishing House, Bombay, 1987).
10. Organic Chemistry-Reactions and Mechanism by P S Kalsi
11. Advanced Organic Chemistry : Reactions and Mechanisms by M.S. Singh
12. Organic chemistry by Cram, Hammond, Pine and Hendrickson
13. Photochemistry and Pericyclic Reactions by Jagdamba Singh
14. Pericyclic reactions: A text book by S. Sankararaman
15. Excited states in Organic Chemistry by J. D. Coyle and J. A. Barltrop
16. March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure by Michael B. Smith
17. Advanced Organic Chemistry: Part B: Reaction and Synthesis by Carey & Francis
18. Organic Chemistry by Jonathan Clayden



VEER NARMAD SOUTH GUJARAT UNIVERSITY M.Sc.-I (CHEMISTRY)

PROPOSED SYLLABUS TO BE EFFECTIVE FROM JUNE-2018

PAPER-III (PHYSICAL CHEMISTRY)

Max. Marks: 100 (External – 70 + Internal – 30)

Total Periods: 45

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UNIT-I: THEORIES OF ELECTROLYTIC CONDUCTANCE AND OVER VOLTAGE **11 Periods**

Debye-Huckel theory of strong electrolytes, relaxation effect and electrophoretic effect, Debye Falkenhagen effect, Weineffect. Ionic strength and its determination, Debye-Huckel limiting law. Activity and activity coefficient, determination of activity coefficient by (i) solubility (solubility product principle) (ii) EMF method (cell without transference), Determination of dissociation constant of monobasic acid by conductance method and approximate EMF method, Electrolytic polarization, Dissolution and Decomposition potential, Concentration polarization, Decomposition potential and its determination, over voltage, determination of over voltage, theories of over voltage: combination of atom as slow process (Tafel theory)

Numerical.

UNIT-II: SURFACE CHEMISTRY

11 Periods

Adsorption Multilayer Adsorption, the BET adsorption isotherms, derivation of BET equation, determination of surface area and area of cross section of molecules by BET equation. Derivation of Langmuir equation from BET equation. Explanation of different adsorption isotherms, Change in enthalpy, entropy and free energy of adsorption, Adsorption at the surface of liquid: Gibbs adsorption isotherms (derivation). Thermodynamic treatment of adsorption, Surface – Active substances, orientations of surfactants on the surface of solution, surface inactive substances, surface pressure, Insoluble surface films on liquid

Numerical

UNIT-III: COLLOIDS:

11 Periods

Types of colloidal systems, preparation of lyophobic colloidal, Properties of Colloidal systems: (i) electrical properties origin of charges on colloidal, electrical double layer, Zeta potential and its determination by electrophoresis, factor affecting zeta potential, explanation on DLVO theory of colloid stability (ii) Electrokinetic properties: Electrophoresis, electroosmosis.

Surface active agents, critical micellar concentration (CMC), factors affecting the CMC of surfactants, thermodynamics of micellization: mass action and phase separation model, solubilisation, emulsion, types of emulsion, methods for determination of types of emulsion, microemulsion, types of microemulsion, theories of microemulsion.



UNIT IV: MOLECULAR SPECTROSCOPY

12 Periods

Molecular spectra, **Microwave spectroscopy** (Rotational spectroscopy): The Rotation of molecules, Linear molecule, Symmetric tops, Spherical tops, Asymmetric tops, Rotational spectra of rigid diatomic molecule, Intensities of spectral lines, Effect of isotopic substitution, Techniques and instrumentation of rotational spectrum,

IR Spectroscopy: Classical frequency of harmonic oscillator, The classical potential energy of harmonic vibration of a diatomic molecule, Quantum expression of potential energy, energy level diagram, Relative population of energy levels, Mechanism of interaction with radiation, selection rule, determination of force constant, Amplitude of vibration, The anharmonic vibration or oscillator, Morse potential, Vibrational energy of diatomic molecule following the Morse potential, energy level diagram, vibrational transitions.

Vibrational –Rotational spectra of diatomic molecule (CO molecule) Application of Vibrational rotational spectra

Numerical

Reference Book:

1. Atkins, P.W., Physical Chemistry, W.H. Freeman (2017) 10th edition
2. Samuel Glasstone, Introduction to Electro chemistry, East-West Press Pvt. Ltd. (2008)
3. Puri, B.R., Sharma, L.R., and Pathania, M.S., Principles of Physical Chemistry, Vishal Publishing Co. (2017-18) 45th ed. Debye-Huckel theory of strong electrolytes, relaxation effect and electrophoretic effect, Debye Falkenhagen effect, Wien effect. Ionic strength and its determination, Debye-Huckel limiting law page 866-874 Insoluble surface films on liquid page no. 1025
Types of colloidal systems, preparation of lyophobic colloidal, Properties of Colloidal systems: (i) electrical properties origin of charges on colloidal, electrical double layer, Zeta potential and its determination by electrophoresis, factor affecting zeta potential, explanation on DLVO theory of colloid stability (ii) Electrokinetic properties: Electrophoresis, electroosmosis. Page no. 989-1001
4. **Fundamentals of Molecular Spectroscopy C N Banwell TATA McGRAW-HILL 15th edition**
Molecular spectra page no.-1 Microwave spectroscopy (Rotational spectroscopy): The Rotation of molecules Linear molecule, Symmetric tops, Spherical tops Asymmetric tops, Rotational spectra of rigid diatomic molecule, Intensities of spectral lines, Effect of isotopic substitution page no. 40-53 Techniques and instrumentation of rotational spectrum page no. 66 –67 Quantum expression of potential energy, energy level diagram, Relative population of energy levels, Mechanism of interaction with radiation, selection rule, determination of force constant, The anharmonic vibration or oscillator, Morse potential, Vibrational energy of diatomic molecule following the Morse potential, energy level diagram, vibrational transitions. Vibrational –Rotational spectra of CO molecule Application of Vibrational rotational spectra page no. 72-88
5. **A Text Book of Physical chemistry K. L. Kapoor Vol-4 Macmillan India Ltd. 3rd edition**
Classical frequency of harmonic oscillator, The classical potential energy of harmonic vibration of a diatomic molecule, Quantum expression of potential energy, energy level diagram, Relative population of energy levels, Mechanism of interaction with radiation, selection rule, determination of force constant, Amplitude of vibration, The anharmonic vibration or oscillator, Morse potential, Vibrational energy of diatomic molecule following the Morse potential, energy level diagram, vibrational transitions page no.



460-471 Vibrational –Rotational spectra of diatomic molecule Application of Vibrational rotational spectra page no. 480-484

Raman Spectrum in detail page no. 488-500

6 A Text Book of Physical Chemistry K. L. Kapoor Vol -5 Macmillan India Ltd. 3rd edition

Adsorption Multilayer Adsorption, the BET adsorption isotherms, derivation of BET equation, determination of surface area and area of cross section of molecules by BET equation. Derivation of Langmuir equation from BET equation. Explanation of different adsorption isotherms, Change in enthalpy, entropy and free energy of adsorption, Adsorption at the surface of liquid : Gibbs adsorption isotherms (derivation). Thermodynamic treatment of adsorption, Surface –Active substances, orientations of surfactants on the surface of solution, surface inactive substances, surface pressure page no. 11-22, 24-26, 30-32, 34-38

7 Advanced Physical Chemistry D.N.Bajpai, S.CHAND & COMPANY LTD. 2nd edition

Activity and activity coefficient, determination of activity coefficient by (i) solubility (solubility product principle) (ii) EMF method (cell without transference), page no. 623-626

SEMESTER -II

GROUP – C PHYSICAL PRACTICAL (Any Six)

1. Determine the dissociation constant and strength of borax solution pH-metrically.
2. Determine the velocity constant of the hydrolysis of ethyl acetate with sodium hydroxide at room temperature by conductance measurements.
3. Determine the solubility of silver chloride in water potentiometrically.
4. To determine the concentration of given components in a mixture colorimetrically.
5. Determine the equilibrium constant of the reaction $I + I_2 = I_3$ by distribution method.
6. Investigation the reaction between H_2O_2 and HI at two different temperatures and calculate the energy of activation for the reaction
7. Determine the formula of a complex between Cu^{+2} and NH_3 by distribution method.
8. Determine CST of Phenol -Water system
9. Determine CST of Phenol –NaCl system

Note : For instrumental analysis, solution should be prepared by the candidate.



VEER NARMAD SOUTH GUJARAT UNIVERSITY M.Sc.-I (CHEMISTRY)

PROPOSED SYLLABUS TO EFFECTIVE FROM JUNE-2018

PAPER-IV (Instrumental and chemical analysis)

Max. Marks: 100 (External –70 + Internal – 30)

Total Periods: 45

UNIT-I: IR SPECTROPHOTOMETRY

12 Periods

IR Spectroscopy: Introduction: Theory, Instrumentation: single beam, double beam spectrophotometers, radiation sources, sample cells, monochromators, detectors, sample handling, Resolution, wave number measurement, Useful terms: IR region, types of vibrations: fundamental and overtones, linear and nonlinear molecule, equation for vibrational frequency, selection rule, coupling interactions, hydrogen bonding information, Fermi resonance. IR spectra: group frequency, group frequency region, finger print region, spectra interpretations (Amino, carboxyls, hydroxyl, ethers groups containing compounds) and structure elucidation. FTIR: principle, instrument design, and function of beam splitter, Advantages of FTIR vs. IR.

UNIT-II: LIQUID CHROMATOGRAPHY

11 Periods

Principle of Liquid – Solid chromatography, Comparison with GC, Column chromatography, Gradient elution, Displacement chromatography, Principle of HPLC, Instrument and significance of each component, Pumps, Guard column Criteria in selection of mobile phase, Stationary phases (solid, liquid), Bonded phase supports, Detectors: UV absorption, RI detectors – Normal phase and Reversed phase. Method of introducing sample.

UNIT-III GREEN CHEMISTRY AND WATER ANALYSIS

11 Periods

(A) Green Chemistry

(04 Periods)

Twelve principles, Green solvents and their applications: Ionic liquids, types, properties and applications, ILs as solvents, Supercritical fluids, Supercritical CO₂, its properties and applications in dry cleaning and decaffeination of coffee.

(B) Water analysis

(07 Periods)

Sources of water pollution, Sewage and industrial effluents, Analysis of water pollutants, Sampling, Preservation, Measurement of parameters such as COD, BOD, DO, TDS, suspended solids, TCC, phenols, fluoride.

UNIT-IV TITRIMETRIC METHODS AND ELEMENTAL ANALYSIS 11 Periods

(A) Solution and Their Concentration:

(03 Periods)

Molarity, Molality, Normality, ppm, ppb, ppt, %w/v, %w/w, %v/v, Formality, Primary and Secondary standard, Acid Value, Density and Specific Gravity, Numerical.



(B) Non Aqueous Titration:**(04 Periods)**

Protic and Aprotic Solvent, Solvent system, Dielectric constant, Titrant, Titration Curve, Determination of Equivalence point, Karl Fisher Titration, Numerical.

(C) Elemental Analysis:**(04 Periods)**

Step on Analysis, C and H Analysis, N Analysis, Halogen Analysis and Sulphur Analysis, Numerical.

Reference book:

1. Fundamental of molecular spectroscopy, C.N. Banwell, Tata McGraw Hill Pub. Camp.
2. Spectrometric Identification of Organic Compounds (4th edition/5th edition), Silverstein, Bassler & Morrill, John Wiley & Sons.
3. Introduction to Molecular Spectroscopy, G.M. Barrow, McGraw – Hill.
4. Modern Spectroscopy, J.M. Hollas, John Wiley.
5. Basic Principles of Spectroscopy, R. Chang, McGraw-Hill.
6. Modern Methods of Chemical Analysis (2nd ed.), Pecsok, Shields, Cairns & McWilliam, John Wiley & Sons.
7. Instrumental Analysis by R. D. Braun, McGraw-Hill.
8. Mathematics for Chemistry, Doggett and Sucliffe, Longman.
9. Mathematical preparation for Physical Chemistry, F. Daniels, McGraw Hill.
10. Introduction to Instrumental Analysis by R. D. Braun, McGraw-Hill Book.
11. Fundamentals of Analytical Chemistry: Skoog D.R. and West D.M. (Holt, Rinehart & Winston, New York).
12. Chemical Analysis in Industry (in Gujarati) by M. N. Desai.
13. Instrumental Methods of Analysis by G. W. Ewing.
14. Modern Method of Chemical Analysis by Pecsok, Shield, Cairns, McWilliam, John Wiley and Sons.
15. Quantitative Analysis, 6th Ed., R.A. Day and A.L. Underwood, Prentice– Hall of India, 1993.
16. Instrumental Analysis: G. D. Caristian and J. E. O'Reilly (Allyn & Bacon Inc., New York, 2nd edition).
17. Instrumental Methods of Chemical Analysis: G. W. Ewing (McGraw-Hill, New York), 5th edition.
18. Instrumental Methods of Analysis: H. R. Willard, L. L. Merrit, J. A. Dean, F. A. Settle (Van Nostrand Reinhold Co., New York), 6th edition.
19. Modern Methods of Chemical Analysis: Pecsok, Shield & Cairns (John Wiley), 2nd edition.
20. Introduction to Instrumental Analysis (1987), R. D. Braun (McGraw-Hill Book Company), New Delhi.
21. Analytical Chemistry: Principles and Techniques: Larry G. Hargis (Prentice-Hall International edition).
22. Introduction to Modern Liquid Chromatography: L. R. Snyder & J. J. Kirkland (John Wiley & Sons, New York).
23. Treatise on Analytical Chemistry: I. M. Kolthoff & P. J. Elving (John Wiley & Sons, New York).
24. Handbook of Analytical Chemistry: L. Meites (McGraw-Hill, New York).
25. Environmental Chemistry: B. R. Sharma, H. Kaur (Goel Publishing House, Meerut).
26. Environmental Chemistry by A.K.de
27. Spectrometric Identification of Organic Compounds; By Robert M. Silverstein, Francis X. Webster, David J. Kiemle, David L. Bryce, Eight edition, Published by Wiley



28. Introduction to Spectroscopy; By Donald L. Pavia, Gary M. Lampman, George S. Kriz, James A. Vyvyan, Fourth edition, Published by Brooks Cole.
29. Spectroscopic Methods in Organic Chemistry; By D.H Williams, I. Fleming, Sixth edition, Published by Tata Mcgraw Hill Education.
30. Spectroscopy of Organic Compounds; By P S Kalsi, Sixth edition, Ne Age International Publisher.
31. Organic Spectroscopy: Principles and Applications; By Jag Mohan, Second edition, Published by Alpha Science International Ltd.
32. Organic Spectroscopy (NMR, IR, Mass and UV); By Dewan S.K., First edition, CBS Publisher & Distributors Pvt Ltd.
33. Basic Principles of Spectroscopy; By Raymond Chang, Published by McGraw-Hill Inc.
34. Elementary Organic Spectroscopy; By Y R Sharma, S. Chand & Company Pvt. Ltd.
35. Organic Spectroscopy; By William Kemp, Published by Palgrave Macmillan.

36. Green chemistry by V. K. Ahluwalia, Narosa Pub New Delhi
37. Green Chemistry, Theory and Practice, P. T. Anastas and John C. Warner, Oxford University Press, 2000, New York, USA.
38. Green Chemistry: An Introductory Text, Mike Lancaster, Green Chemistry Network, University of York, RSC, 2002.



M.Sc. - Semester – II (PRACTICALS)

Preparation of organic compounds : (Minimum six)

- (i) Nitration : m-dinitrobenzene from Nitrobenzene
- (ii) Bromination: p-bromoacetanilide from acetanilide
- (iii) Reduction: m-phenylenediamine from m-dinitrobenzene
- (iv) Oxidation : p-nitrobenzoic acid from p-nitrotoluene
- (v) Diazotization reaction: Orange-I
- (vi) Friedl-Craft's reaction: Resacetophenone from Resocinol
- (vii) Cannizzaro reaction: Benzoic acid from Benzaldehyde via KOH
- (viii) Aldol condensation: Chalcone from Benzaldehyde + Acetophenone (Claisen Schmidt reaction)

Quantitative Estimations: (Minimum three)

- a. Estimation of ester + acid
- b. Estimation of formaldehyde
- c. Estimation of glycine
- d. Estimation of amide + acid

References:

1. A text book of practical organic chemistry – A. I. Vogel
2. Practical organic Chemistry – Mann and Saunders
3. A handbook of quantitative and qualitative analysis – H. T. Clarke
4. Comprehensive Practical Organic Chemistry : Qualitative Analysis V K Ahluwalia & S. Dhingra.
5. Comprehensive Practical Organic Chemistry : Preparations and Quantitative Analysis V K Ahluwalia & R. Aggarwal Universities Press.
6. An Advance Course in practical Chemistry, A K. Nad, B. Mahapatra and A. Ghoshal.

