GANPAT UNIVERSITY

FACULTY OF SCIENCE

TEACHING AND EXAMINATION SCHEME

Programme	Bachelor of Science	Branch/Spec.	CHEMISTRY
Semester	VI		

Subject Code	Subject Name	Teaching scheme												Examination scheme (Marks)					
		Credit						Hours (per week)						Theory			Practical		
		Lecture(DT)			Practical(Lab.)			Lecture(DT)			Practical(Lab.)			CE	SEE	Total	CE	SEE	Total
		L	TU	Total	P	TW	Total	L	TU	Total	P	TW	Total						
UCHA 601 IOC	Inorganic Chemistry	03	-	03	-	-	-	03	-	03	-	-	-	40	60	100	-	-	-
UCHA 602 ORC	Organic Chemistry	03	-	03	-	-	-	03	-	03	-	-	-	40	60	100	-	-	-
UCHA 603 PHC	Physical Chemistry	03	-	03	-	-	-	03	-	03	-	-	-	40	60	100	-	-	-
UCHA 604 SAC	Structural - Analytical Chemistry	03	-	03	-	-	-	03	-	03	-	-	-	40	60	100	-	-	-
USEB 605 FOA	Food Additives (OR)	02	-	02	-	-	-	02	-	02	-	-	-	40	60	100	-	-	-
USEB 605 GRC	Green Chemistry (OR)																		
USEB 605 POC	Polymer Chemistry																		
UENA 606 ENG	ENGLISH-VI	02	-	02	-	-	-	02	-	02	-	-	-	40	60	100	-	-	-
UPCA 607 PRA	Practical Module – VI	-	-	-	06	-	06	-	-	-	12	-	12	-	-	-	80	120	200
	Total	16	-	16	06	-	06	16	-	16	12	-	12	240	360	600	80	120	200

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Programme	Bachelor of SCIENCE	Branch/Spec.	CHEMISTRY
Semester	VI	Version	1.0.0.0
Effective from Academic Year	2015-16	Effective for the batch Admitted in	July 2013
Subject code	UCHA 601 IOC	Subject Name	Inorganic Chemistry

Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	--	--	--	3	Theory	40	60	100
Hours	3	--	--	--	3	Practical	--	--	--

Pre-requisites:

- Before studying Inorganic chemistry, all students have basic knowledge of inorganic and organic compounds, periodic table, molecular structure, Molecular orbital theories and knowledge related to UG level chemistry.

Learning Outcome:

- Knowledge of V.B. and M. O. theories and their uses.
- Introduction and classification of metal carbonyls.
- Knowledge of structural bonding and properties of metal carbonyl compounds.
- Knowledge of bioinorganic chemistry.

Theory syllabus

Unit	Content	Hrs
1	**Valency** • Variation method, Secular Equation, Stability of H_2^+ ion; M.O. approach, Stability of H_2 molecule; V. B. approach, Classical interaction energy • Representation of wave function for SP, SP^2 and SP^3 hybride orbitals, bond angle and bond strength • M.O. treatment of Oh molecules • Quantum mechanical representation of Pauli's exclusion principle	15
2	**Metal Carbonyl** • Introduction • Classification: Mononuclear and Polynuclear • Physical and Chemical Properties • Metal Carbonyl (M-CO) bonding (On the basis of V.B.T. and M.O.T.) • Use of IR Spectra to determination of structure of metal carbonyl • Structure of Metal Carbonyl Ni(CO)4,Fe(CO)5,Cr(CO)6,Fe2(CO)9,Co2(CO)8,Mn2(CO)10, Fe3(CO)12 • Calculation of EAN of metal atom in metal carbonyl • Metal Nitrosyl complexes: - Bonding in metal nitrosyl • Classification of metal Nitrosyl	15
3	**Bio-Inorganic Chemistry** • Introduction, • Essential elements, • Trace elements • Metal porphyrine, • Study of hemoglobin and myoglobin	15

	• Nitrogen fixation: In Vivo and In Vitro	
Text Books		
1	Inorganic Chemistry by S. Chand.	
2	Text book of Inorganic Chemistry by Durent and Durent.	
Reference Books		
1	Valance and molecular structure by Cartmell and Flower.	
2	Advance Inorganic Chemistry Vol-II Satya Prakash (S.Chand)	
3	Concise Inorganic chemistry by J.D.Lee.	
4	Metalic Corrosion By M.N. Desai	
5	Advance Inorganic Chemistry J.E. Huhee	

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Programme	Bachelor of SCIENCE	Branch/Spec.	CHEMISTRY
Semester	VI	Version	1.0.0.0
Effective from Academic Year	2015-16	Effective for the batch Admitted in	July 2013
Subject code	UCHA 602 ORC	Subject Name	Organic Chemistry

Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	--	--	--	3	Theory	40	60	100
Hours	3	--	--	--	3	Practical	--	--	--

Pre-requisites:

- Before studying organic chemistry, all students have basic knowledge of general organic chemistry. Students should have the deep knowledge about the elementary organic chemistry at the UG level.

Learning Outcome:

- Knowledge of electrophilic and free radical addition reactions.
- Mechanisms and theories of addition reactions.
- Studying the chemistry of active methylene group compounds.
- Understanding the concept of tautomerism.
- Understanding the nucleophilic aromatic substitution reactions and their mechanisms.

Theory syllabus

Unit	Content	Hrs
1	**Electrophilic and free radical addition reaction** • Addition to carbon carbon double bond • Markovnikov's rule • Electrophilic addition, Orientation, Reactivity, Rearrangement, Dimerization, Alkylation • Peroxide effect (Anti Markovnikov's rule) ; Free radical addition, mechanism of peroxide initiated addition of HBr • Syn and anti-addition mechanism for addition of halogens • Electrophilic addition to conjugated dienes (1: 2 v/s 1: 4 addition) • Free radical addition to conjugated dienes, reactivity	15
2	**Active Methylene Group Compounds** • Introduction of Tautomerism • Determination of Keto-enol Tautomerism • Differences between Tautomerism and resonance • Synthesis and application of Ethyl aceto acetate and malonic ester	15
3	**Nucleophilic Aromatic Substitutions** • Nucleophilic aromatic substitution [Bimolecular displacement (SN^2) mechanism] • Elimination – Addition mechanism via benzyne • Stability and properties of benzyne • Evidences of Benzyne intermediate	15

Text Books

1	*Organic chemistry by Morrison & Boyd Vth Edition*

2	Advance organic chemistry by R.K.Bansal.
3	Organic chemistry by I.L.Finar Vol I &.II Vth Edition
Reference Books	
1	Organic chemistry by pine, Hendrikson, Cram and Hammond IVth edition...
2	Outline of chemical technology by Dryden IInd Edition
3	Synthetic organic chemistry by Gurdeep R Chatwal.
4	Advanced organic chemistry by Jerry March.
5	Organic reactions and their mechanisms IInd edition by P.S. Kalsi.
6	Organic chemistry of natural product Vol: I & II by Gurdeep R. Chatwal.
7	Advanced organic chemistry by Arun Bahal and B.S. Bahal.
8	Organic chemistry Vol, I, II, III by S.M.Mukherjee, S.P.Singh, R.P.Kapoor.

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Programme	Bachelor of SCIENCE	Branch/Spec.	CHEMISTRY
Semester	VI	Version	1.0.0.0
Effective from Academic Year	2015-16	Effective for the batch Admitted in	July 2013
Subject code	UPCA 603 PHC	Subject Name	Physical Chemistry

Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	--	--	--	3	Theory	40	60	100
Hours	3	--	--	--	3	Practical	--	--	--

Pre-requisites:

- Before learning Physical chemistry, student should aware about basic principles and theories of physical chemistry, thermodynamics, solutions, photochemistry, rate of reactions , rate law's and other UG level chemistry.

Learning Outcome:

- Understanding of the laws of thermodynamics.
- Understanding of the laws of absorption.
- Knowledge of photochemistry and laws of photochemistry.
- Knowledge of chemical kinetics.

Theory syllabus

Unit	Content	Hrs
1	**Thermodynamics** • Zeroth law of thermodynamics • Absolute temperature scale • Nernst heat theorem • Third law of thermodynamics • Determination of absolute entropy • Experimental verification of third law • Entropy change in chemical reactions. • Concept of Fugacity and determination of Graphical Method • Numerical	15
2	**Photochemistry** • Introduction • Difference between Thermal and Photochemical reaction • The Law of Absorption, Lambert-Beer law • Laws of Photochemistry, (1) Grothus-Drappper law (2) Stark- Einstein law and it's devation • Quantum Efficiency or Quantum Yield • Experimental determination of Quantum yield • Reason of high and low Quantum yield • Types of Photochemical reaction (1) Photosensitized reaction (2) Photochemical equilibrium • Qualitative description of fluorescence, phosphorescence and • chemiluminescence's • Flash Photolysis	15

	• Numerical	
3	**Chemical Kinetics** • Effect of temperature on rate of reaction (Arhaneous equation) • Concept of Activation energy • Theories of reaction rate (1) Collision theory (2) Transition state theory • Comparison of collision and transition state theory • Theories of Unimolecular reaction • Lindeman's theory • Trimolecular reaction • Trautz's Law • Primary salt effect • Secondary salt effect • Numerical	**15**

Text Books	
1	Advance Physical Chemistry by Gurdeep Raj.
2	Physical Chemistry (Question and Answer) by R. N. Madan, G.D. Tuli, S.Chand.
3	Principal of Physical Chemistry by Puri, Sharma, Pathania.
4	Chemical Thermodynamics by R.P. Rastogi and R.R.Mishra.
Reference Books	
1	Physical chemistry by atkins.
2	Essentials of Physical Chemistry by B. S. Bahal, Arun Bahal, G.D.Tuli,
3	Physical Chemistry by P.W. Atkins, 5^{th} edn, Oxford 1994 7^{th} edn-2002.
4	Physical Chemistry by R.A. Albern and R.J.Silby, John Wiley 1995.
5	Physical Chemistry by G.H. Barrow, 5^{th} edn, Mac Graw Hill, 1988,6^{th} edn,1996.
6	Physical Chemistry by W.J.Moore, 4^{th} edn, Orient Longmans 1969.

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Programme	Bachelor of SCIENCE	Branch/Spec.	CHEMISTRY
Semester	VI	Version	1.0.0.0
Effective from Academic Year	2015-16	Effective for the batch Admitted in	July 2013
Subject code	UPCA 604 SAC	Subject Name	Structural Analytical Chemistry

Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	--	--	--	3	Theory	40	60	100
Hours	3	--	--	--	3	Practical	--	--	--

Pre-requisites:

- Before learning analytical chemistry, student should aware about basic principles and theories of analytical chemistry, Basics of chromatography, spectroscopy and other UG level chemistry

Learning Outcome:

- Knowledge of term symbols.
- Understanding of the spectra of octahedral complexes.
- Knowledge of IR spectroscopy and calculation of fundamental modes of vibrations.
- Interpretation of organic compounds using combined spectroscopic problems.
- Understanding of the basic concept of chromatography and knowledge of various chromatographic techniques.

Theory syllabus

Unit	Content	Hrs
1	**Term symbol & spectra of d^1-d^9 Octahedral complexes** **(A)**Term Symbol • LS couplings • J J coupling • Determination of ground state term by Hund's rules • Determination of term symbol for all state for p^2 & d^2 configuration by pigeon hole diagram **(B)**Spectra of d^1 & d^9 • octahedral complexes • Selection rules & intensities transitions • Orgel diagram for d^1-d^9,d^2-d^8,d^3-d^7,d^4-d^6 octahedral & tetrahedral complexes explanation of d^1 & d^9 spectra(only introduction-no application)	15
2	**IR spectra & Numerical based on UV, IR and NMR Spectra** (2015) Infrared spectroscopy. • Introduction • Molecular vibrations (Fundamental vibrations of AX2 type molecules) • Characteristics of IR spectroscopy • Sample techniques • Fingerprint zone • Effect of IR in geometrical isomerism • IR spectra & H-bonding • Factor affecting on >C=O group frequencies • Differentiate two compounds by the IR frequencies.	15

	(B) Problems pertaining to the structure elucidation of organic compounds using • UV, IR & NMR spectroscopic techniques	
3	**Chromatography** • Introduction • Types of chromatography • Column chromatography • Paper chromatography • Thin layer chromatography • Ion exchange chromatography • Van-dimmter 9quator-only equation • examples • HPLC principle • Application of chromatography	**15**

Text Books	
1	Chemical application of group theory by F.A.Cotton
2	Chemical bonding and introduction by K.C.Patel, R.D.Patel and Raval
3	Application of group theory to chemistry by Bhattacharya
4	Symmetry in chemistry by Jafle and Orchin
5	Advance inorganic chemistry by cotton & Wilkinson
6	Basic principles of spectroscopy by R.Chand
7	Organic chemistry Vol. 1 by S.M.Mukherji, S.P.Shingh, Kapoor
8	Spectroscopy organic compounds VIth edition by P.S.kalsi

Reference Books	
1	Organic chemistry by Morrison and Boyd
2	Spectrometric identification of organic compounds IVth edition by Silverstain, Bassler and Morrill.
3	Application of absorption spectroscopy of organic compounds by John R. Dyer
4	Spectroscopic method in organic chemistry Vth edition by Dudley H. Williams & Ian Fleming
5	Physical methods for chemist Ruwssell S. Drago
6	Organic spectroscopy by Williams & Kemp
7	Organic spectroscopy by V.R.Dani
8	Qualitative Analysis R.A.Day & A.L.Underwood
9	Analytical Chemistry G.D. Christain
10	Fundamentals of Analytical Chemistry D.A.Skoog, D.M. West & F.J.Holler
11	Principales of Analytical Chemistry J.H. Kennedy
12	Analytical Chemistry – Principals & Techniques L.G.Hargis

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Programme	Bachelor of SCIENCE		Branch/Spec.	CHEMISTRY	
Semester	VI		Version	1.0.1.0	
Effective from Academic Year		2015-16	Effective for the batch Admitted in		July 2013
Subject code	USEB 605 FOA	Subject Name	Food Additives		

Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	2	--	--	--	2	Theory	40	60	100
Hours	2	--	--	--	2	Practical	--	--	--

Pre-requisites:

- Before learning food additives, student should aware about basic principles and theories of general chemistry.

Learning Outcome:

- Introduction of food additives.
- Classification of Food additives.
- Knowledge of Authorized Food Additives.

Theory syllabus

Unit	Content	Hrs
1	• Introduction • Food Additives and functionalities • Food additives regulations - GRAS - The Delaney closes - Unintentional • Assessment of Food Additives	15
2	• Classification of Food additives • Mechanism and chemistry of - Flavoring Agents - Emulsifiers - Acidulants - Antioxidants - Thikners - Sweeteners - Food colours - Preservatives - Aroma • Functional classes Food Additives • List of Authorized Food Additives • Risk benefit Ratio	15

Reference Books

1	Food Chemistry by Alex V. Ramani, MJP Publications, 2009
2	CRC Handbook of Food Additives 2nd Edition, Volume No. II, 2011

3	Tanya Lousise Ditschun and Carl K. Winter 2000
4	Food and Safety and authority of Ireland Published by guidance of Food Additives 2010

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Programme	Bachelor of SCIENCE	Branch/Spec.	CHEMISTRY
Semester	VI	Version	1.0.0.0
Effective from Academic Year	2015-16	Effective for the batch Admitted in	July 2013
Subject code	USEB 605 GRC	Subject Name	Green Chemistry

Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	2	--	--	--	2	Theory	40	60	100
Hours	2	--	--	--	2	Practical	--	--	--

Pre-requisites:

- Before learning green chemistry, student should aware about basic principles and theories of general chemistry.

Learning Outcome:

- Basic knowledge of green chemistry.
- Understanding the importance of green chemistry.
- Knowledge of designing green synthesis.

Theory syllabus

Unit	Content	Hrs
1	**Basics of Green Chemistry** • The need for green chemistry • Eco-efficiency- environmental protection laws • Challenges --pollution control and pollution • Green methods, green products, recycling of waste • Twelve principles of green chemistry • Inception of green chemistry--awards for green chemistry • International organizations promoting green chemistry.	15
2	**Designing Green Synthesis** • Choice of starting materials, choice of r eagents, choice of catalysts • Bio catalysts, polymer supported catalysts, choice of solvents • Synthesis involving basic principles of green chemistry • Examples –adipic acid, catechol, methyl methacrylate, urethane, aromatic amines 4-aminodiphenylamine), benzyl bromide, acetaldehyde, citral, ibuprofen, paracetamol,	15

Reference Books

1	V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry,Anamalaya Publishers (2005).
2	V. Kumar, An Introduction to Green Chemistry, Vishal Publishing CO. Jalandhar, 2007.
3	Sanghi A Shrivastav Green Chemistry

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Programme	Bachelor of SCIENCE	Branch/Spec.	CHEMISTRY
Semester	VI	Version	1.0.0.0
Effective from Academic Year	2015-16	Effective for the batch Admitted in	July 2013
Subject code	USEB 605 POC	Subject Name	Polymer Chemistry

Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	2	--	--	--	2	Theory	40	60	100
Hours	2	--	--	--	2	Practical	--	--	--

Pre-requisites:

- Before learning polymer chemistry, student should aware about basic principles and theories of general chemistry and organic chemistry.

Learning Outcome:

- Introduction, Classification and Nomenclature of polymers.
- Understanding the kinetics of polymerisation.
- Understanding the techniques of polymerisation.
- Determination of molecular weight of polymers.

Theory syllabus

Unit	Content	Hrs
1	**Polymers – 1** • Introduction • Classification and Nomenclature of polymers • Isomerism of polymers • Chain growth polymerization – Introduction • Mechanism of free-radical, Cationic and Anionic polymerization • Kinetics of free radical, Cationic and Anionic polymerization • Mechanism and Kinetics polycondensation	15
2	**Polymers - 2** • Polymerization Techniques • Concept of Averages - Number average molecular weight - Weight average molecular weight - Viscosity average molecular weight • Molecular weight and Degree of polymerization • Poly dispersity and molecular weight distribution • Methods for determination of molecular weight • Membrane Osmometry, Viscometry and Light Scattering	15

Reference Books

1	Principles of polymers Science by P.Bahadur and N.V.Shastry.(Second Edition)
2	Polymer Science by V.R.Gowariker, N.V.Vashwanathan and Jaydev Shreedhar

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Programme	Bachelor of SCIENCE	Branch/Spec.	CHEMISTRY
Semester	VI	Version	1.0.0.0
Effective from Academic Year	2015-16	Effective for the batch Admitted in	July 2013
Subject code	UENA 606 ENG	Subject Name	ENGLISH-VI

Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	2	--	--	--	2	Theory	40	60	100
Hours	2	--	--	--	2	Practical	--	--	--

Pre-requisites:

- Students should have basic knowledge of English Language and grammar.
- Students should have ability to speak and write correct sentences in their day to day language.
- Students should be familiar with correct usage of language.

Learning Outcome:

- Development of reading and writing skills.
- Writing for newspapers.
- Development of electronic communication skills.

Theory syllabus

Unit	Content	Hrs
1	**Les Miserables by Victor Hugo**	8
2	**Les Miserables by Victor Hugo**	7
3	**Writing For Newspapers** ➢ Drafting News Article ➢ Press Release for College Event, ➢ University Event, ➢ Educational News	8
4	**Electronic Communication** ➢ Participating in Telephonic Communication, ➢ Making Notes of phone calls received on behalf of others, ➢ Communicating through email, ➢ Voice Mail	7

Reference Books

1	Les Miserables by Victor Hugo
2	Text book of Business communication by Anjali Karkar and others, Orient Black Swan Publication
3	Business Communication by Urmila Rai and S. M. Rai
4	Business Communication by Rodha Doctor and Aspi Doctor

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Programme	Bachelor of SCIENCE		Branch/Spec.	CHEMISTRY	
Semester	VI		Version	1.0.0.0	
Effective from Academic Year		2015-16	Effective for the batch Admitted in		July 2013
Subject code	UPCA 607 PRA	Subject Name	Practical Module-VI		

Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	--	--	6	--	6	Theory	--	--	--
Hours	--	--	12	--	12	Practical	--	200	200

Pre-requisites:

- Before performing these practicals, students have basic knowledge of laboratory chemicals, organic and inorganic compounds and their properties, basics of colorimetry, conductometry and potentiometry, apparatus and instruments which are used in performing chemistry practicals.

Learning Outcome:

- Qualitative analysis of inorganic mixture.
- Estimation of functional groups of various organic molecules.
- Synthesis of organic compounds.
- Separation of drugs or dyes using thin layer chromatography

Practical syllabus

Inorganic Chemistry Practical

Qualitative analysis (Minimum 10)

Inorganic mixture should be comprised of six radicals. Candidate if required should be guided once for the wrong group and marks deducted for wrong group. Maximum of five marks can be deducted for wrong group. There shell be no deduction of marks for reporting wrong radicals

Organic Chemistry Practical

(A) Estimation of functional groups: (Minimum 03)

(1) Estimation of Ester
(2) Estimation of Amide
(3) Estimation of Ascorbic acid
(4) Estimation of Aspirin

(B) Synthesis of Organic Compounds (Minimum 05)

(1) Preparation of m-Dinitro benzene from Nitrobenzene
(2) Preparation of p-Nitro acetanilide from Acetanilide
(3) Preparation of Acetanilide from Aniline
(4) Preparation of Aspirin from Salicylic acid
(5) Preparation of Di-benzal acetone from Benzaldehyde
(6) Preparation of 2,4,6-Tribromo aniline from Aniline

(C) TLC of Drugs and Dyes

1. TLC of two different Drugs
2. TLC of two different Dyes

Physical Chemistry Practical

ss[Instruments]: (Minimum 06)

1**.** To determine concentration of the given Iodide solution by Potentiometric titration against 0.1N $KMnO_4$

solution.

2. To determine formal redox potential of Fe^{+2}/Fe^{+3} by Potentiometric.
3. To determine the concentration of the nitrite in the given solution by Colorimetric estimation method.
4. To determine the concentration of unknown solution from given $K_2Cr_2O_7$ by Calorimetry.
5. To determine the Solubility product and solubility of sparingy soluble salt of BaSO4 by Conductometry.
6. To determine the strength of strong and weak base in a given mixture using a pH meter.

[B] Kinetics, Adsorption & Polymer (Minimum 04)

7. To study the reaction between $KBrO_3$ and KI at two different temperature and calculate the temperature coefficient and the energy of activation.
8. To study the absorption of Acetic Acid on Charcoal and prove the validity of freundlich equation.
9. To determination of molecular weight of high polymer (i.e. polystyrene) by Viscosity mesasurent.
10. To study the rate constant of the reaction between $K_2S_2O_8$ and KI and study the influence of ionic strength on the rate constant