GOKUL GLOBAL UNIVERSITY
Approved By Govt. of Gujarat
(Recognized by UGC under Section 22 & 2(f) of 1956)
(Gujarat Private State University Act 4 of 2018)

COURSE STRUCTURE

Bachelor of Science

Chemistry

Faculty of Science
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Semester I(CPM)

S. NO.	CODE	SUBJECT	TEACHING SCHEME			CREDIT	CONTACT HRS/WK
			L	T	P		
THEORY							
1	BCHE101UDSC	Core Course- I (Paper-I) (Chemistry) Inorganic, Organic, Physical Chemistry & Volumetric Analysis	4	0	0	4	4
2	BCHE101SE	Elective Course- I (Course-I) Agricultural Chemistry	2	0	0	2	2
3	BPHY101UDSC	Mechanics And Basic Electronics(MAE)	4	0	0	4	4
4	B101EG	Communication Skills	2	0	0	2	2
5	BMAT101UDSC	(Mathematics) Differential Calculus	4	0	0	4	4
6	B101FC	Foundation Compulsory- English	2	0	0	2	2
Practicals							
1	BCHE101PRA	Practical Core Course- I (Paper-I) (Chemistry)	0	0	4	2	4
2	BPHY101UPRA	Practical Module-01	0	0	4	2	4
3	BMAT101UPRA	Mathematics Practical – I	0	0	4	2	4
TOTAL			18	0	12	24	30

Semester I(CBZ)

S. NO.	CODE	SUBJECT	TEACHING SCHEME			CREDIT	CONTACT HRS/WK
			L	T	P		
THEORY							
1	BCHE101UDSC	Core Course- I (Paper-I) (Chemistry) Inorganic, Organic, Physical Chemistry & Volumetric Analysis	4	0	0	4	4
2	BCHE101SE	Elective Course- I (Course-I) Agricultural Chemistry	2	0	0	2	2
3	BBOT101UDSC	Microbiology & Phycology/	4	0	0	4	4
4	BZOO101UDSC	Non - Chordates I Protista To Pseudocoelomates	4	0	0	4	4
5	B101FC	Foundation Compulsory- English	2	0	0	2	2
6	B101EG	Elective Generic: Communication Skills	2	0	0	2	2
PRACTICALS							
1	BCHE101PRA	Practical Core Course- I (Paper-I) (Chemistry)	0	0	4	2	4
2	BBOT101UPRA	Botony Practical	0	0	4	2	4
3	BZOO101UPRA	Zoology Practical	0		4	2	4
TOTAL			18	0	12	24	30

Semester 2(CPM)

S. NO.	CODE	SUBJECT	TEACHING SCHEME			CREDIT	CONTACT HRS/WK
			L	T	P		
THEORY							
1	BCHE201UDSC	Core Course- I (Paper-I) (Chemistry) Inorganic, Organic, Physical Chemistry	4	0	0	4	4
2	BCHE201SE	Elective Subject- I (Course-I) Medicinal Chemistry	2	0	0	2	2
3	BMAT201UDSC	INTEGRAL CALCULUS &Amp; DIFFERENTIALEQUATION	4	0	0	4	4
4	BPHY201UDSC	Wave, Optics, Electronics & Semiconductor Device(Woes)	4	0	0	4	4
5	B201FC	Foundation Compulsory- English	2	0	0	2	2
6	B201UEG	Elective Generic: Disaster Management	2	0	0	2	2
PRACTICALS							
1	BCHE201PRA	Practical Core Course- I (Paper-II) (Chemistry)	2	0	4	2	4
2	BMAT201PRA	(Mathematics) Mathematics Practical – II	2	0	4	2	4
3	BPHY201PRA	Physics Practical-II	2	0	4	2	4
TOTAL			18	0	12	24	30

Semester 2(CBZ)

S. NO.	CODE	SUBJECT	TEACHING SCHEME			CREDIT	CONTAC HRS/W
			L	T	P		
THEORY							
1	BCHE201UDSC	Core Course- I (Paper-I) (Chemistry) Inorganic, Organic, Physical Chemistry	4	0	0	4	4
2	BCHE201SE	Elective Subject- I (Course-I) Medicinal Chemistry	2	0	0	2	2
3	BBOT201UDSC/	Biomolecules And Cell Biology/	4	0	0	4	4
4	BZOO201UDSC	Non - Chordates I Protista To Pseudocoelomates	4	0	0	4	4
5	B201FC	Foundation Compulsory- English	2	0	0	2	2
6	B201UEG	Elective Generic: Disaster Management	2	0	0	2	2
PRACTICALS							
1	BCHE201PRA	Practical Core Course- I (PAPER-II) (CHEMISTRY)	0	0	4	2	4
2	BBOT201UPRA/	Botany Practical	0	0	4	2	4
3	BZOO201UPRA	Zoology Practical	0	0	4	2	4
TOTAL			18	0	12	24	30

Semester III

S. NO.	CODE	SUBJECT	TEACHING SCHEME			CREDIT	CONTACT HRS/WK
			L	T	P(hrs)		
THEORY							
1	BCHE301UDSC	Core Course- I (Paper-I) (Chemistry) Iinorganic & Organic Chemistry	3	0	0	3	3
2	BCHE302UDSC	Core Course- Ii (Paper-I) (Chemistry) Physical Chemistry	3	0	0	3	3
3	BCHE301SE	Elective Subject- I (Course-I) Environmental Chemistry Or Elective Subject- I (Course-I) Water Quality Analysis	2	0	0	2	2
4	B301FC	Foundation Compulsory -English	2	0	0	2	2
5	BBOT301UDSC/ BPHY301UDSC	Mycology And Phytopathology/ OPTICS,MODERN PHYSICS & LASER(OMPL)	3	0	0	3	3
6	BBOT302UDSC/ BPHY302UDSC	Archegoniate/ SOLID STATE,NUCLEAR & MATHEMATICAL PHYSICS(SSNM)	3	0	0	3	3
7	B301EG	Personality Development	2	0	0	0	2
PRACTICALS							
1	BCHE301PRA	Practical Core Course- I (PAPER-I) (CHEMISTRY)	0	0	6	3	6
2	BBOT301UPRA/ (BPHY301UPRA + BPHY302UPRA)	Botany Practical/ (Physics Practical-301+ Physics Practical-302)	0	0	6	3	6
TOTAL			18	0	12	24	30

Semester 4

. NO.	CODE	SUBJECT	TEACHINGSCHEME				CREDIT	CONTACT HRS/WK
			L	T	P	J		
1	BCHE401UDSC	Core Course- I (Paper-I) (Chemistry) Iinorganic & Organic Chemistry	**3**	0	0		**3**	**3**
2	BCHE402UDSC	Core Course- Ii (Paper-I) (Chemistry) Physical Chemistry & Spectrosocpy	**3**	0	0		**3**	**3**
3	BCHE401SE	Elective Subject- I (Course-I) Green Chemistry Or Elective Subject- I (Course-I) Dna: A Molecule Of Life	**2**	0	0		**2**	**2**
4	B401FC	Foundation Compulsory –English	**2**	0	0	0	**2**	**2**
5	BBOT401UDSC/ BPHY401UDSC	Anatomy Of Angiosperms/ ELECTROMAGNETISM,ELECTRONICS & PLASMA PHYSICS (EMEP)	**3**	0	0	0	**3**	**3**
6	BBOT402UDSC/ BPHY402UDSC	Economic Botany/ Quantum Mechanics, Solid State & Thermodynamics(Qmsst)	**3**	0	0	0	**3**	**3**
7	B401EG	Human Rights	**2**	0	0	0	**0**	**2**
Practicals								
1	BCHE401PRA	Practical Core Course- I (PAPER-I) (CHEMISTRY)	**0**	0	6		3	6
2	BBOT401UPRA/ (BPHY401UPRA+ BPHY402UPRA)	Botany Practical/ (PHYSICS PRACTICAL-401+ PHYSICS PRACTICAL-402)	**0**	0	6		3	6
TOTAL			18	0	12	0	24	30

Semester V

S. NO.	CODE	SUBJECT	TEACHING SCHEME				CREDIT	CONTACT HRS/WK	PREREQUISITE	COREQUISITE
			L	T	P	J				
THEORY										
1	BCHE501UDSC	Core Course- I (PAPER-I) (CHEMISTRY) INORGANIC CHEMISTRY	3	00	0	0	3	3		
2	BCHE502UDSC	Core Course- I (PAPER-I) (CHEMISTRY) ORGANIC CHEMISTRY	3	0	0	0	3	3		
3	BCHE503UDSC	Core Course- I (PAPER-I) (CHEMISTRY) PHYSICAL CHEMISTRY	3	0	0	0	3	3		
4	BCHE504UDSC	Core Course- I (PAPER-I) (CHEMISTRY) ANALYTICAL CHEMISTRY	3	0	0	0	3	3		
5	BCHE501SE	Elective Subject- I (Course-I) SYNTHETIC DYES OR Elective Subject- I (Course-I) PHARMACEUTICAL CHEMISTRY	2	0	0	0	2	2		
6	B501EG	Environment and Sustainable development	2	0	0	0	0	2		
Practical										
1	BCHE501PRA	Practical Core Course- I (PAPER-I) (CHEMISTRY)	0	0	06	0	06	6		
		Total	**18**	**0**	**12**	**0**	**24**	**30**		

Semester VI

S. NO.	CODE	SUBJECT	TEACHING SCHEME				CREDIT	CONTACT HRS/WK	PREREQUISITE	COREQUISITE
			L	T	P	J				
THEORY										
1	BCHE601UDSC	Core Course- I (Paper-I) (Chemistry) Inorganic Chemistry	3	0	0	0	3	3		
2	BCHE602UDSC	Core Course- I (Paper-I) (Chemistry) Organic Chemistry	3	0	0	0	3	3		
3	BCHE603UDSC	Core Course- I (Paper-I) (Chemistry) Physical Chemistry	3	0	0	0	3	3		
4	BCHE604UDSC	Core Course- I (Paper-I) (Chemistry) Analytical Chemistry	3	0	0	0	3	3		
	BCHE601SE	Elective Subject- I (Course-I) Polymer Chemistry Or Elective Subject- I (Course-I) Food Additives	2	0	0	0	2	2		
	B601EG	Stress Management	2	0	0	0	0	2		
Practical										
	BCHE601PRA	Practical Core Course- I (PAPER-I) (CHEMISTRY)	0	0	06	0	06	6		
		Total	**18**	**0**	**12**	**0**	**24**	**30**		

Subject Code: BCHE101UDSC **Semester: I**
Subject Name: Inorganic- Organic Chemistry & Volumetric Analysis **Faculty Name/s:**
Credit: 04 **4-0-0-0**

Unit	Content	Hrs.	Weightage
1	**Inorganic Chemistry** **Chemical Bonding** Valence bond theory and its limitations, Directional characteristics of Covalent bond, Various types of Hybridization and Shape of Simple Inorganic Molecules V.S.E.P.R.- Theory for NH_3 & H_2O, M.O. Theory –Energy level diagram for homo nucleus diatomic molecules (N_2&O_2) and hetero-nucleus diatomic molecules (CO &NO), Metallic bond: Free electron, valence bond and band theories.	15	30 %
2	**Organic Chemistry** **Structure and Bonding** Intramolecular forces (dipol-dipol interaction, vander waal's forces), Electromeric effect, Inductive effect, Resonance effect, Hyper conjugation (o, p-directing effect of Alkyl group, Stabilityof Carbonium ion and Free radicals), Hybridization, bond lengths and bond angles, bond energy, Localized and delocalized chemicalbonds.	10	15%

3	**Organic Chemistry** **Mechanism of Organic Reaction** Fission of Covalent bond (With at least one example of each intermediates), Types of Reagents, Types of organic Reaction with Mechanism, Elimination Reaction (E1&E2).	**15**	**30 %**
4	**Volumetric Analysis** **Principle, Mechanism and Applications of…** Acid-Base titrations Redox titrations Complexometric titrationsPrecipitation Titrations.	**15**	**25%**

Course Outcomes: At the end of the course, students shall be able to

CO1	The students will learn the important analytical and instrumental tools used for practicing chemistry.
CO2	To develop interest among students in various branches of inorganic chemistry.
CO3	To impart students a broad outline of the methodology of science in general and Chemistry in particular.
CO4	To impart essential theoretical knowledge on atomic structure, periodic properties and chemical bonding.
CO5	To develop skills for quantitative estimation using the different branches of volumetric Analysis

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**-**	**3**	**2**	**1**	**-**	**2**	**-**	**1**	**2**			
CO2	**2**	**2**	**1**	**1**	**1**	**0**	**0**	**1**	**1**			
CO3	**2**	**2**	**2**	**1**	**1**	**2**	**2**	**1**	**1**			
CO4	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**			
CO5	**2**	**1**	**2**	**2**	**1**	**1**	**1**	**1**	**2**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**1**	**3**
CO2													**1**	**2**
CO3													**3**	**2**

CO4													**2**	**-**
CO5													**2**	**2**

Subject Code: BCHE101USE **Semester: I**
Subject Name: AGRICULTURAL CHEMISTRY **Faculty Name/s:**

Credits: 02 **L-T-P-J: 2-0-0-0**

Unit: 1 FERTILIZERS

- Plant Nutrients, Major Nutrients, Minor Nutrients, Trace Nutrients
- Definition of Fertilizer
- Classification of Fertilizer
- Synthesis of N Containing Fertilizer i.e. $(NH_4)_2SO_4$, $Ca(CN)_2$, and Urea
- Synthesis of P Containing Fertilizer i.e. Super Phosphate, Triple Super Phosphate
- Mix Fertilizer

Unit: 2 INSECTICIDE

- Introduction
- Inorganic Insecticide
- Organic Insecticide
- Natural or Plant Insecticide
- Synthesis of DDT, BHC, Malathion.

Reference: Industrial Chemistry by B.K.Sharma.

Course Outcomes: At the end of the course, students shall be able to

CO1	Student after learning this course can seek employment in areas of Agriculture, farms, Educational Institutes etc as Junior Scientist, Assistant Professor, Content Developer, and Researcher etc.
CO2	Student will be able to relate different kind of Nutrients and Insecticide for standard their uses. They will be able to explain various types of Nutrients and Insecticide.
CO3	Develop basic communication skills through working in groups.
CO4	Apply the various procedures and techniques for the experiments.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	**1**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**3**			
CO2	**1**	**1**	**1**	**-**	**1**	**1**	**-**	**2**	**2**			
CO3	**1**	**2**	**1**	**3**	**3**	**1**	**1**	**-**	**2**			
CO4	**-**	**3**	**2**	**-**	**1**	**2**	**1**	**1**	**1**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	**Program Outcomes**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**1**	**2**
CO2													**1**	**1**
CO3													**2**	**2**
CO4													**2**	**3**
CO5														

LIST OF PRACTICALSB.Sc. Sem - I

(BCHE101UPRA)

1. Organic Chemistry

- Identification of an organic compound through the functional group analysis, Determination of melting point and boiling point, Preparation of suitable derivative.
- Candidate should perform the analysis of at least 10 compounds.

List of compounds

- **Acids:**
  Benzoic acid, Cinnamic acid, Phthalic acid, Oxalic acid, Succinic acid.
- **Phenols:**
  α–Naphthol, β– Naphthol.
- **Bases:**
  P-Toludine, Diphenylamine, Aniline, Methyl aniline.
- **Neutrals:**
  Naphthalene, Anthracene, Acetamide, Benzamide, Acetanilide,m- Dinitrobenzene, Urea, Thiourea, Toluene, Acetone, Benzaldehyde, Methyl acetate, Ethyl acetate,Chloroform,Carbon tetrachloride, Chlorobenzene,Nitrobenzene.

2. Volumetric Titrations

- To determine the strength of NaOH and Na_2CO_3 present in the solution mixture of NaOH & Na_2CO_3 and to find out their percentage composition.
- To determine the strength of $NaHCO_3$ and Na_2CO_3 present in the solution mixture of $NaHCO_3$ & Na_2CO_3 and to find out their percentage composition.
- To determine the Normality, gm/liter and molarities of $H_2C_2O_4.2H_2O$and H_2SO_4 present in the solution mixture of $H_2C_2O_4.2H_2O$ & H_2SO_4 by using X N NaOH and Y N $KMnO_4$ solutions.
- To determine the Normality, gm/liter and molarity of $H_2C_2O_4.2H_2O$ and $K_2C_2O_4$ present in the solution mixture of $H_2C_2O_4.2H_2O$ & $K_2C_2O_4$ by using X N NaOH and Y N $KMnO_4$ solutions.
- To determine the amount of Ca^{+2} and Mg^{+2} ion by EDTA solution from themixture solution of $CaCl_2$ and $MgCl_2$.

3. Demonstrations

- Melting point and Boiling point of an organic compound.
- Calibration of burette and Pipette.

Subject Code: BCHE201UDSC **Semester: II**
Subject Name: Inorganic, Organic & Physical Chemistry **Faculty Name/s:**
Credits: 04 **L-T-P-J: 4-0-0-0**

Unit	Content	Hrs.	Weightage
1	**Inorganic Chemistry**		
	A. F- Block elements	15	25%
	Lanthanide's electronic Configuration, Oxidation state, Lanthanide Contraction, Effects of Lanthanide Contraction, Separation method: (a). Solvent extraction method (b). Ion exchange method.		
	B. Noble Gases		
	Chemical properties of Noble gases, Chemistry of Xenon,Structure and Bonding in Xenon Compounds.		
	Organic Chemistry		
2	**Stereo Chemistry**	15	25%
	A. Optical isomerism: -		
	General, Discussion of elements of symmetry, Molecular Chirality, Enantiomers, Optical activity, Properties of enantiomers, Chiral and Achiral molecules with two stereo genic centers, Diastereomers, Threo and Erythro diastereomers, Meso Compounds.		
	B. Geometrical isomerism: -		
	Definition and general discussion of geometric isomers,General methods of structure determination (physical methods), E-Z systems of nomenclature (Simple illustration should be given).		
	C. Conformational isomerism: -		

	Conformational analysis of ethane and n- butane, Conformations of cyclohexane, axial and equatorial bonds,		

	Newmann projection and sawhorse formulae, Fischer&Flying wedge formulae. Difference between configuration and conformation.		
3	**Aromatic Hydrocarbons** Aromaticity: Criteria for aromatic, non-aromatic and anti-aromatic types, applications of Huckel's rule to simple annulene, cyclic carbocation/anion, Electrophilic aromaticsubstitution reactions of benzene with Mechanism, Theory ofeffect of substituents on reactivity and orientation (withresonating structures for activating and deactivating groups), Electrophilic aromatic substitution reactions of the followingsWith mechanisms: Halogenation, nitration, sulphonation,Friedel Crafts alkylation, Friedel Crafts acylation.	**15**	**25%**
4	**Physical Chemistry** **Thermodynamics** Thermodynamics terms, 1st law of thermodynamics, Heat capacity, work done of ideal gases under isothermal & adiabatic condition for reversible process, 2nd law of thermodynamics, carnot cycle and its efficiency, Entropy,Numerical. **Chemical Kinetics** Rate of reaction, Order of reaction, Molecularity, Rate equation for second order reaction. (a=b) & (a≠b), Characteristics of second order reaction**,** Rate equation for third order reaction, Characteristics of third order reaction, Numerical.	**15**	**25%**

Reference Books: Inorganic Chemistry

Advanced Inorganic Chemistry, Vol I & II. Satya Prakash, G.D. Tuli, S.K. Basu and R.D.Madan.

Inorganic Chemistry', D.F. Shriver, P.W. Atkins, 3rd Edition, Oxford, 1999.

Essentials of Nuclear Chemistry' H.J. Arnical, 4th Edition, New Age International, 1995.

Advanced Inorganic Chemistry - Raymond Chang

Inorganic Chemistry - P. L. Soni.

Co-ordination Chemistry – Banerjee.

Reference Books: Organic Chemistry

Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice-Hall.

Organic Chemistry, (Volume I, II & III. S. M. Mukherji, S. P. Singh and R. P. Kapoor.

Stereochemistry of Carbon Compounds, Ernest L. Eliel, McGraw Hill.

Stereochemistry of Organic Compounds, P.S. Kalsi, New Age International.

Stereochemistry of Organic Compounds, D. Nasipuri, New Age International.

Organic Chemistry by Francis A. Carey.

A Text Book of Organic Chemistry: (Volume I & II) O. P. Agarwal

Reference Books: Physical Chemistry

Physical Chemistry by R.A. Albert and R.J. Silby, John Wiley1995.

Advance Physical Chemistry by Gurdeep raj.

Essentials of Physical Chemistry, B. S. Bahal, G. D. Tuli and Arun Bahal, S. Chand & Co. New Delhi.

Elements of Physical Chemistry, B. R. Puri, L. R. Sharma and Madan Pathania Vishal Publishing Co. Jalandhar.

Principles of Physical Chemistry, Samuel H. Maron and Carl F. Prutton, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

Chemical Kinetics, G. R. Chatwal and Harish Mishra, Goel Publication House. Meerut.

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to relate different kind of chemical bonding and structure of various chemicals. They will be able to explain various bonding of a various groups.
CO2	Develop basic communication skills through working in groups in performing the laboratory

	experiments and by interpreting the results.
CO3	Apply the various procedures and techniques for the experiments.
CO4	To make students capable of understanding and studying nomenclature, classification of organic compounds and reactions.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**-**	**1**	**1**	**-**	**-**	**-**	**1**	**-**			
CO2	**-**	**3**	**2**	**1**	**-**	**2**	**2**	**2**	**2**			
CO3	**2**	**3**	**2**	**2**	**1**	**2**	**1**	**2**	**2**			
CO4	**2**	**-**	**-**	**2**	**1**	**1**	**1**	**1**	**1**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**1**
CO2													**2**	**3**
CO3													**3**	**3**
CO4													**2**	**1**
CO5														

Subject Code: BCHE201USE **Semester: II**

Subject Name: MEDICINAL CHEMISTRY **Faculty Name/s:**

Credits: 02 **L-T-P-J: 2-0-0-0**

Unit	Content	Hrs.	Weightage
1	**Introduction** Introduction of Drugs, History of medicinal chemistry, Classification of drugs, General importance of drugs, Drug design.	15	50%
2	**Anti-Malarial Drugs** Introduction and History, Life cycle of Plasmodium, Natural anti-malarial drugs: Role of activity side in quinine structure, Classification of anti-malarial drugs, Synthesis of Quinoline derivatives: 8- Amino Quinoline derivatives (Plasmoquine &Pamaquine)	15	50%

REFERENCE BOOKS: -

1. Berger's Medicinal Chemistry (Volume.1-8), VII edition – J Abraham, Wiley.
2. Medicinal Chemistry – Ashutosh Kar, New Age International Publishers.
3. Medicinal Chemistry-An Introduction – G.Thomas, John Wiley.

Course Outcomes: At the end of the course, students shall be able to

CO1	Student after learning this course can seek employment in areas of medical, pharmacy sector, Educational Institutes etc, As Junior Scientist, Assistant Professor, and a Researcher etc.
CO2	Student will be able to relate different kind of drugs for standard their uses. They will be able to explain various types of anti-malarial drugs
CO3	Develop basic communication skills through working in groups
CO4	Apply the various procedures and techniques for the experiments

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**			
CO2	**2**	**2**	**1**	**1**	**1**	**2**	**1**	**-**	**1**			
CO3	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**			
CO4	**2**	**3**	**3**	**1**	**2**	**2**	**2**	**2**	**1**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**3**
CO2													**2**	**1**
CO3													**3**	**3**
CO4													**3**	**3**
CO5														

Subject Code:

LIST OF PRACTICALS

B.Sc. Sem – II

BCHE201UPRA

1. Inorganic Chemistry

- **Semi microAnalysis:**

  - Cation analysis; separation and identification of ions from group I, II, III-A,III-B, IV, V-A, V-B.

Anion: Cl^-, Br^-, I^-, NO_3^-, NO_2^-, SO_4^{-2}, SO_3^{-2}, S^{-2}, CrO_4^{-2}, CO_3^{-2}, PO_4^{-3} 4 3 4 3 4 3 4

(Water Soluble and insoluble).

- Candidate should perform the analysis of at least 10compounds.

2. Standardization

- Preparation of standard solution of succinic acid and standardization ofNaOH/KOH solution.
- Preparation of standard solution of $Na_2S_2O_3$ and standardization of I_2solution.
- Preparation of standard solution of EDTA and estimation of Ca^{+2}/Mg^{+2} in$CaCl_2/MgCl_2$ solution.
- Preparation of standard solution of Oxalic acid and standardization of$KMnO_4$ solution.
- Preparation of standard solution of $K_2Cr_2O_7$ and standardization of$FeSO_4$ solution.

3. Demonstrations

- Preparation of standard stock solution by w/v method and their differentdilutions.
- Preparation of standard stock solution of HCl by v/v method andtheirdifferent dilutions.

Subject Code: BCHE301UDSC

Subject Name: INORGANIC & ORGANIC CHEMISTRY **Faculty Name/s:**

Credits: 03 **L-T-P-J: 3-0-0-0**

Unit	Content	Hrs.	Weightage
1.	**Acid-Base Properties** Proton acids-bases and Lewis's acids-bases, Arrhenius concept of Acids and Bases, Bronsted Lowery theory of acids and bases, pH of acids and bases, Factors effecting on acidity and basicity of compounds, Resonance effect (Drawing resonance structures and the conditions for resonance.), Inductive and electronic effects, Effect of hybridization, Steric effect, Effects by hydrogen bonding.	15	33%
2.	**Co-ordination Compounds** Definition, Nomenclature of Complex, Werner's theory and its experimental verification, concept of Effective Atomic Numbers (E.A.N.) for Co-ordination Compounds, Limitations of Valence bond theory of transition metal Complexes, An Elementary idea of(C.F.T.) Crystal field splitting of d-orbital in Oh, Td and Square planar, Factors effecting to the Crystal field splitting, Application of common Complexes & chelates.	15	33%
3.	**Amino acids & Peptides** **Amino acids** Introduction, Classification and nomenclature, Dipolar ion structure and Isoelectric point, Synthesis of amino acids (Gabriel Phthalimide, Strecker, Fischer-Malonic ester), Reaction of amino acid.	15	34%
	Peptides Geometry of peptide linkage, Synthesis of peptides (Bergmann Method, Sheehan Method), Determination of structure of peptide by terminal residue analysis.		

REFERENCE BOOKS:

• Inorganic Chemistry: -

1. Quantum Chemistry by R.K. Prasad, Revised 3rd Edition, Page- 3,5,7,34-37,41,65-68.

2. Concise Inorganic Chemistry J.D. Lee, 4th Edition, ELBS publication.

• Organic Chemistry: -

1. Organic Chemistry by Morrison and Boyd. 4th Edition, Pearson Education-2003

2. Organic Chemistry by pine, Hendriction, Cram and Hammond 4thEditionby P.S. Kalsi.

3. Advance Organic Chemistry by Arun Bahal and B.S. Bahal.

4. Organic Chemistry Vol. I & II by S.M. Mukherjee, S.P. Singh, R.P. Kapoor.

Course Outcomes: At the end of the course, students shall be able to

CO1	To give the students a thorough knowledge of the different theories to explain the bonding in coordination compounds.
CO2	To improve the level of understanding of the chemistry of organometallic compounds, metal carbonyls and metal clusters
CO3	To give knowledge about some bioinorganic compounds.
CO4	To develop interest among students in various branches of inorganic chemistry.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**1**	**2**	**1**	**1**	**1**	**2**	**2**			
CO2	**3**	**1**	**1**	**2**	**1**	**1**	**1**	**2**	**2**			
CO3	**3**	**1**	**1**	**2**	**1**	**1**	**1**	**2**	**2**			
CO4	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**2**	**2**
CO3													**2**	**2**
CO4													**3**	**2**
CO5														

Subject Code: BCHE302UDSC **Semester: III**
Subject Name: PHYSICAL CHEMISTRY **Faculty Name/s:**
Credits: 03 **L-T-P-J: 3-0-0-0**

Unit	Content	Hrs.	Weightage
1.	**Wave Mechanics** Black Body Radiation & Quantum Theory, Basic postulates of quantum Mechanics, Photo electric effect: Wave particle duality of radiation, Compton effect, Free particle system, Particle in one-dimension box, Operator: Definition, Algebra of operators, Addition, Multiplication, Commutative properties, Linear operator, Commutator operators, Laplacian operator.	**15**	**33%**
2.	**Nuclear Chemistry** Concept of Nuclear particle, Definition of Isotopes, Isotones, Isobars, Isomers, Packing fraction, Nuclear binding energy, Nuclear coulomb barrier, Rate of ratio active disintegration, half-life period, Average life period, Rutherford's law (Group transfer law), Numerical.	**15**	**33%**
3.	**The Vacancy Theory of Liquid** Vapor-Pressure, Dipole moment and its measurements & its application, Numerical, Surface tension:(1) Measurement of surface tension by stalagmometer. (2) Perachor and its applications, Measurement of viscosity by Ostwald-viscometer, Measurement of Optical activity by Polarimeter, Refractive index: - (1) Specific refraction (2) Molar refraction (3) Measurement of Refractive index by Abbe's Refractometer.	**15**	**34%**

REFERENCE BOOKS

•Physical Chemistry:

1. Advance Physical Chemistry by Gurdeep Raj

2. Physical Chemistry (Question and Answers) by R.D. Madan, G.D. Tully, S. Chand.

3. Principal of Physical Chemistry by Puri, Sharma, Pathania.

4. Chemical Thermodynamics by R.P. Rastogi and R.R. Mishra.

5. Essentials of Physical Chemistry by B.S. Bahal, Arun Bahal, G.D. Tully.

6. Physical Chemistry by P.W. Atkins, 5th Edition, Oxford, 1994, 7th Edition,2002

Course Outcomes: At the end of the course, students shall be able to

CO1	Student after learning this course can be introduced about the basic postulates of quantum mechanics.
CO2	Learn the measurement of viscosity by Ostwald-viscometer.
CO3	Understand the concept of nuclear particle
CO4	To understand the general characteristics of different states of matter.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**2**	**1**	**1**	**2**	**1**	**2**	**1**			
CO2	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**2**	**2**			
CO3	**3**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**			
CO4	**3**	**2**	**-**	**1**	**-**	**1**	**1**	**1**	**1**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**3**
CO2													**3**	**3**
CO3													**2**	**3**
CO4													**3**	**3**
CO5														

Subject Code: BCHE301USE **Semester: III**

Subject Name: Environmental Pollution **Faculty Name/s:**

Credits: 02 **L-T-P-J: 2-0-0-0**

Unit	Content	Hrs.	Weightage
1.	**Air and Water Pollution** Introduction, Classification of pollutant,Types of pollution, Air pollution,Source of air pollution, Acid Rain, Emissions of major industrial air pollutant, Water pollution, Types of Water pollution: Physical & Chemicals, Biological and Physiological,Source of Water Pollution.	**15**	**50%**
2.	**Soil and Noise Pollution** Soil pollution,Sources of soil pollution, Effect of Modern Agro-technology on Soil, Noise Pollution,Thermal Pollution, Radio Active Pollution,Prevention of pollution.	**15**	**50%**

REFERENCE BOOKS:

1. Industrial Chemistry by B.K. Sharma.

Course Outcomes: At the end of the course, students shall be able to

CO1	Student after learning this course can seek employment in areas of various pollution control board as Junior Scientist and Researcher etc.
CO2	Student will be able to relate different kind of pollution controls
CO3	Develop basic communication skills through working in groups
CO4	Apply the various procedures and techniques for the experiments

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**2**			
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**			
CO3	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**2**	**2**			
CO4	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2**	**2**			

CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**3**
CO2													**3**	**3**
CO3													**2**	**3**
CO4													**3**	**3**
CO5														

Gokul Global University, Siddhpur			
ProgrammeCode:	**BCHE**	**ProgrammeName:**	B.Sc. Chemistry
Course Code:	**BCHE301UPRA**	**Semester:**	III
CHEMISTRY PRACTICAL			

Credit: 03

LIST OF PRACTICALS

Organic Chemistry

Separation of Organic Mixture.(Any 7 out of 10)

Mixture Containing Two Compounds (Only Water Insoluble SolidCompounds taken)

Physical Chemistry(Any 7 out of 10)

1) Conductometrictitration: - HCl / CH_3COOH Vs NaOH
2) Conductometrictitration: - HCl Vs NH_4OH
3) pH- metric titration: -
    i. Calibration of pH - meter by 4 - pH buffer
    ii. HCl Vs NaOH
4) Determine the Dissociation constant of the acid of mixtures CH_3COONa and CH_3COOH by determine the pH.
5) Determine the specific refraction and molar refraction of the givenliquid A, B and mixture C (A+B) and calculate the percentage composition of A and B in the mixture C by Abbe's Refractrometer.
6) Determine the molar refraction $CH_3COOC_2H_5$, $CH_3COOC_3H_7$and$CH_3COOC_4H_9$ and show the constancy of reaction equivalent of $-CH_2-$ Group by Abbe's Refractrometer.
7) To determine the viscosity of a different mixture of liquid A and Band determine the percentage composition of unknown mixture bygraphical method.
8) To determine the surface tension and compare cleaning-efficiency oftwo samples of a detergent or soap with stalagmometer.
9) To study kinetic reaction of decomposition of H_2O_2 catalysis by iodineion (Clock reaction).
10) Find the solubility and heat of solution of the given organic acid attwo differenttemperatures.

Subject Code: BCHE401UDSC **Semester: IV**

Subject Name: INORGANIC & ORGANIC CHEMISTRY **Faculty Name/s:**

Credits: 03 **L-T-P-J: 3-0-0-0**

Unit	Content	Hrs.	Weightage
1.	**Boron Hydride** Introduction and Classification of hydrides, Preparation, properties structure and use of Diborane, Bridge bonding in B_2H_6 (M.O. and SP^3 approach), Structure of higher Borones: - B_4H_{10}, B_5H_9, B_5H_{11}, B_6H_{10}, $B_{10}H_{14}$.	15	33%
2.	**Application of CFT** Application of C.F.T. 1) For determination of colour ofcomplex. 2) Use of C.F.S.E.value Limitation of C.F.T, Isomerism in complexes **Magnetic properties of Co-ordination Compound** Type of magnetic behavior, Method of determining magnetic susceptibility, Spin only formula, Magnetic properties for 3rd metal complexes, Gouy Method.	15	33%
3.	**Heterocyclic Compound** Introduction, Nomenclature, Molecular orbital picture and aromatic characteristics of Pyrrole, Furan, Thiophene and Pyridine, Methods of synthesis for Pyrrole, Furan, Thiophene and Pyridine, Chemical reactions for Pyrrole, Furan and Thiophene, Electrophilic and Nucleophilic substitution reactions of pyridine, Basicity of Pyridine, Piperidine and pyrrole. **Carbohydrates** Introduction, Definition, Classification of Mono Saccharides, Nomenclature, Reactions of Glucose and Fructose (Methylation, Acetylation, Oxidation with Br_2 water and Conc.HNO_3, Reaction with HCN, NH_4OH, Osazone formation and Epimerization.), Lengthening of carbon chain of aldoses, Shortening of carbon chain of aldoses.	15	34%

REFERENCE BOOKS:

- **InorganicChemistry: -**

1. Advance Inorganic chemistry – Satya Prakash. G.D. Tuli, S.K. Basu, R.D. Madan,S. Chand Volume-II.

2. Advance Inorganic chemistry – Satya Prakash, S. Chand Volume-I. PageNo-819-828.

- **OrganicChemistry: -**

1. Organic Chemistry Vol. I & II by S.M. Mukherji, S.P. Singh,R.P. Kapoor.

2. Reaction mechanism and Reagents in Organic Chemistry byGurdeep R. Chatwal 4th edition Himalaya publicHouse.

3. Spectroscopy of Organic Compounds 6th ed. by P.S. Kalsi.

4. Organic Chemistry Vol. I & II by S.M. Mukherji, S.P. Singh,R.P. Kapoor.

- **PhysicalChemistry: -**

1. Physical Chemistry by R.A. Alberty and R.J. Silbey, John Wiley,1995.

2. Physical Chemistry by G.H. Barrow, 5th edition, Mac Graw Hill,1998,6thedition.

3. Physical Chemistry by W.J. Moore, 4th edition, Orient Longmans,1969.

Course Outcomes: At the end of the course, students shall be able to

CO1	To improve the level of understanding of the chemistry of organometallic compounds, metal carbonyls and metal clusters.
CO2	To give the students thorough knowledge of the different theories to explain the bonding in coordination compounds.
CO3	To impart the students thorough idea in the chemistry of enzymes, amino acids, proteins and nucleic acids.
CO4	To study the fundamentals of terpenoids, alkaloids, vitamins, lipids and steroids.

CO-PO Competency and Program Indicators (PI)

Course	Program Outcomes

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**1**	**1**	**1**	**2**	**1**	**1**			
CO2	**3**	**2**	**2**	**1**	**1**	**1**	**2**	**1**	**1**			
CO3	**3**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	**1**			
CO4	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**3**
CO2													**2**	**3**
CO3													**2**	**2**
CO4													**2**	**2**
CO5														

Subject Code: BCHE402UDSC **Semester: IV**

Subject Name: PHYSICAL CHEMISTRY& SPECTROSCOPY **Faculty Name/s:**

Credits: 03 **L-T-P-J: 3-0-0-0**

Unit	Content	Hrs.	Weightage
1.	**Electro Chemistry** Introduction of terms, Oxidation, Reduction, Redox, Anode, Cathode, Electrode, Half Cell, Oxidation & Reduction Potential, Electrochemical cell (Galvanic Cell) & Representation cell, Electrochemical Series and its Significance, Nernst Equation of Cell EMF and single electrode potential, Numerical. Describe the Electrode: 1) Metal-Metal ion Electrode. 2) Standard Hydrogen Electrode. 3) Calomel Electrode. 4) Weston standard Electrode. 5) Glass Electrode. 6) Quinhydrone Electrode Application of cell potential: 1) Equilibrium constant. 2) Free energy. pH.	**15**	**33%**
2.	**IONIC EQUILIBRIUM** Only Introduction, Electrolysis, Ionic Equilibrium, Resistance, Conductance, Specific conductance, Equivalent Conductance, Molar Conductance, Equivalent Conductance at Infinite Dilution. Type of Conductometric Titration: - Acid-Base titration: 1. Strong Acid Vs Strong Base. 2. Strong Acid Vs Weak Base 3. Weak Acid Vs Strong Base 4. Weak Acid Vs Weak Base 5. Strong Acid + Weak Acid Vs Strong Base Transport number. Determination of Transport Number. 1) Hittorf's Method. 2) Moving Boundary Method Hydrolysis of Salt. Classification	**15**	**33%**

	of Salt. 1) Strong Acid & Strong Base. Strong Acid & Weak Base.		
3.	**Ultraviolet Spectroscopy** Type of electronic transitions, Effect of conjugation, Woodward – fisher rules, Concept of Chromophore and Auxochrome, Bathochromic, Hypsochromic, Hyperchromic, and Hypochromic shifts, Problems of conjugated enes, enones and aromatic ketones, aldehydes, acids and esters using empirical rules, numericals based on λ_{max}.	**15**	**34%**

REFERENCE BOOKS:

- **InorganicChemistry: -**

3. Advance Inorganic chemistry – Satya Prakash. G.D. Tuli, S.K. Basu, R.D. Madan,S. Chand Volume-II.

4. Advance Inorganic chemistry – Satya Prakash, S. Chand Volume-I. PageNo-819-828.

- **OrganicChemistry: -**

5. Organic Chemistry Vol. I & II by S.M. Mukherji, S.P. Singh,R.P. Kapoor.

6. Reaction mechanism and Reagents in Organic Chemistry byGurdeep R. Chatwal 4th edition Himalaya publicHouse.

7. Spectroscopy of Organic Compounds 6th ed. by P.S. Kalsi.

8. Organic Chemistry Vol. I & II by S.M. Mukherji, S.P. Singh,R.P. Kapoor.

- **PhysicalChemistry: -**

4. Physical Chemistry by R.A. Alberty and R.J. Silbey, John Wiley,1995.

5. Physical Chemistry by G.H. Barrow, 5th edition, Mac Graw Hill,1998,6thedition.

6. Physical Chemistry by W.J. Moore, 4th edition, Orient Longmans,1969.

Course Outcomes: At the end of the course, students shall be able to

CO1	Student after learning this course can be introduced about the electro chemistry.
CO2	Learn the types of conductometric titrations and to understand the concept of chromophore and auxochrome
CO3	To impart a thorough knowledge of the fundamentals of microwave, infra-red, Raman, electronic, NMR, and ESR spectroscopy.
CO4	To impart the students' concepts of the fundamentals of quantum mechanics and its applications in the study of structure of atoms, bonding in molecules and molecular spectroscopy

CO-PO Competency and Program Indicators (PI)

Course Outcomes	**Program Outcomes**											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**			
CO2	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**			
CO3	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**			
CO4	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	**Program Outcomes**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**3**
CO2													**3**	**3**
CO3													**3**	**3**
CO4													**3**	**3**
CO5														

Subject Code: BCHE401USE **Semester: IV**

Subject Name: GREEN CHEMISTRY **Faculty Name/s:**

Credits: 02 **L-T-P-J: 2-0-0-0**

Unit	Content	Hrs.	Weightage
1.	**Basics of Green Chemistry** The need for green chemistry, Twelve principles of green chemistry, Eco-efficiency- environmental protection laws, Challenges --pollution control and pollution, Green methods, green products, recycling of waste.	15	50%
2.	**Designing Green Synthesis** Choice of starting materials, choice of reagents, choice of catalysts, Bio catalysts, polymer supported catalysts, choice of solvents, Synthesis involving basic principles of green chemistry, Examples –adipic acid, catechol, benzyl bromide, Acetaldehyde, citral, ibuprofen, paracetamol.	15	50%

REFERENCE BOOKS: -

1. V.K. Ahluwalia & M.R. Kidwai: New Trends in GreenChemistry, Anamalaya Publishers (2005).

2. V. Kumar, An Introduction to Green Chemistry, Vishal Publishing CO. Jalandhar,2007.

3. Sanghi A Shrivastava Green Chemistry.

Course Outcomes: At the end of the course, students shall be able to

CO1	Student after learning this course can seek employment in areas of environmental protection, Educational Institutes etc. as Junior Scientist, Assistant Professor, Content Developer, and Researcher etc.
CO2	Student will be able to relate different kind of green methods and laws for standard their uses. They will be able to explain various types of green methods
CO3	Develop basic communication skills through working in groups
CO4	Apply the various procedures and techniques for the experiments

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**1**			
CO2	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**			
CO3	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**1**	**2**			
CO4	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**2**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**3**
CO2													**2**	**2**
CO3													**2**	**2**
CO4													**3**	**3**
CO5														

Gokul Global University, Siddhpur			
Programme code:	**BCHE**	**Programme Name:**	B.Sc. Chemistry
Course Code:	**BCHE401UPRA**	**Semester:**	IV
CHEMISTRY PRACTICAL			
Course type:	Practical	**Total Credit:**	03

LIST OF PRACTICALS

1. **InorganicChemistry: -**

Inorganicqualitativeanalysis: (Any 7 Mixture out of10)
Mixture Containing 4 Radicals
(Except $PO4^{-3}$,$BO3^{-3}$,$ASO4^{-3}$,$ASO3^{-3}$,O^{-2})

2. **Analytical Chemistry: -**

A. Volumetric Analysis of Cu, Zn, Ni **(**AnyThree)

1. To determine the amount of Zn by EDTAMethod.
2. To determine the amount of Ni by EDTAMethod.
3. To determine the amount of Cu by IodometryMethod.
4. To determine the amount of Cu by EDTAtitration.

B. Estimation of Glucose/Aniline/Phenol (AnyTwo)

1. To determine the amount of Aniline by BrominatingMethod.
2. To determine the amount of Phenol by BrominatingMethod.
3. To determine the amount of Glucose by oxidationMethod.

Subject Code: BCHE501UDSC **Semester: V**

Subject Name: INORGANIC CHEMISTRYFaculty Name/s:

Credits: 03 **L-T-P-J: 3-0-0-0**

Unit	Content	Hrs.	Weightage
1	**Reaction Mechanism of Reaction Mechanism of Transition Metal Complexes** Substitution reaction of square planar complexes, Reaction of Platinum II complexes, the trans effect, theories of trans effect, use of synthesis in trans effect and analysis, Substitution reaction in Octahedral complexes, Possible mechanism reactions, Ligand displacement reaction in Octahedral complexes, Acid hydrolysis, Base hydrolysis, Electron transfer reaction, mechanism of redox reaction, mechanism of substitution in square planar complexes	17	40%
2	**Organometallic Compounds** Definition, Types of Organometallic Compounds, Classification, Nomenclature of O.M.C., Structure and bonding in dihapto and metal policies complexes; e.g. Zeise's salt complexes, ferrocene structure, O.M.C. of Li and Al complexes	14	30%
3	**Corrosion** Principle of Corrosion, Types of Corrosion: Wet corrosion, Galvanic corrosion, Atmospheric corrosion, Pitting corrosion, Inner granual corrosion, Dezincification, Prevention of Corrosion: Inhibitors- Definition, type and use of inhibitors	14	30%

Reference Books:

1) Inorganic Chemistry by S. Chand.

2) Advance Inorganic Chemistry by Satya Prakash Volume-II (S.Chand).

3) Concise Inorganic Chemistry by J.D.Lee.

4) Metallic Corrosion by M.N. Desai

5) Advance Inorganic Chemistry by J.E. Huhee.

Course Outcomes: At the end of the course, students shall be able to

CO1	Organometallic Chemistry is used extensively in the modern world, from the construction of polymers, plastics, and petrol, to electronic circuitry and solar panel construction, to advances in medicine such as immunization inoculations and chemotherapy.
CO2	Student after learning this course can seek employment in areas of Metallurgy Firms, Hospitals, Educational Institutes etc as Junior Scientist, Assistant Professor, Content Developer, Process Engineer, Site Engineer, and Researcher etc.
CO3	Candidates also hold the opportunity to explore the industrial, pharmaceutical, technological and commercial fields of chemistry as the course.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**			
CO2	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**			
CO3	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**2**			
CO4												
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**3**
CO2													**3**	**3**
CO3													**3**	**3**
CO4														
CO5														

Subject Code: BCHE502UDSC **Semester: V**

Subject Name: ORGANIC CHEMISTRY **Faculty Name/s:**

Credits: 03 **L-T-P-J: 3-0-0-0**

Unit	Content	Hrs.	Weightage
1	**Nucleophilic Substitution at saturated carbon atom** The reaction mechanism, stereochemistry of Nucleophilic substitution, Scope of Nucleophilic substitution, Stereochemistry of SN^1 and SN^2 reaction, Relative reactivity in substitution, Solvent effect variation at carbon site, Relative leaving group activity, Neighbouring group participation, Competitivereactions: Elimination E_1, E_2 and E_{1CB} mechanisms.	17	40%
2	**A. Carbohydrates** Introduction of Disaccharides, Structure determination of (i) Sucrose (ii) Maltose. **B. Isoprenoids** Classification, General methods of structure determination, Isoprene rule, Constitution of Citral and α- Terpeneol and their synthesis.	14	30%
3	**Stereochemistry** Conformational analysis of mono and di-substituted cyclohexanes, Molecular symmetry as illustrated by allenes and diphenyls, Isomerism of oximes, Determination of geometrical isomerism of Aldoxime, Determination of geometrical isomerism of Ketoxime (Beckmann's transformation)	14	30%

Reference Books:

1) Organic Chemistry by Morrison & Boyd Vth Edition.

2) Synthetic Organic Chemistry by Jerry March.

3) Organic Chemistry by I.L. Finar Vol. I & II, Vth Edition.

4) Synthetic Organic Chemistry by Gurdeep Chatwal.

5) Organic reactions and their mechanisms 2nd Edition by P.S. Kalsi.

6) Stereochemistry: Confirmation and mechanism VIth edition by P.S. Kalsi.

7) Advanced Organic Chemistry by Bahal & Bahal.

8) Stereochemistry by Nasipuri.

9) Organic Chemistry of natural product Volume I & II by Gurdeep Chatwal.

10) Organic Chemistry Volume I & II by S.M. Mukherjee & S.P. Singh.

Course Outcomes: At the end of the course, students shall be able to

CO1	This course gives the student idea about the Nucleophilic Substitution.
CO2	This is related to saturated carbon atom.
CO3	It has a broad decryption about Sucrose and Maltose.
CO4	This course gives the student brief information about Isoprenoids.
CO5	In the Stereochemistry students know about Conformational analysis of some organic compounds.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**1**	**1**	**2**	**2**	**1**	**1**	**2**			
CO2	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**			
CO3	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**			
CO4	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**2**
CO2													**2**	**2**
CO3													**2**	**2**
CO4													**2**	**2**

Subject Code: BCHE503UDSC Semester: V
Subject Name: PHYSICAL CHEMISTRY **Faculty Name/s:**

Credits: 03 **L-T-P-J: 3-0-0-0**

Unit	Content	Hrs.	Weightage
1	**Electro Motive Force (E.M.F.)** Chemical Cell: Without Transference with Transference Verification of Concentration cell and its EMF equation, Electrolyte concentration cell, Concentration cell without Transference Cell, Concentration with transference cell. Electrode concentration cell, Amalgam Concentration, Gas Concentration Cell, Liquid-Liquid junction Potential application of EMF measurements, Degree of hydrolysis of Salt, Solubility of sparingly soluble salt, Stability constant of complex, Dissociation constant of weakacid. **Numerical**	**14**	**30%**
2	**Statistical thermodynamics** Introduction, combination and permutation, probability, sterling approximate formula, Types of statistics: Maxwell-Boltzman, Bose- Einstein Statistics, Fermi-Direct statistics, Partition Function, translational, vibrational & rotational partition functions. **Numerical**	**15**	**30%**
3	**Macromolecules** Classification of polymers, Tactility of polymers, polymerization reaction with example, Addition polymerization (Polyethylene, Polystyrene, PVC) Condensation Polymerization (Nylon-66,Dacron), Mechanism of polymerization,- (i) Free radical chain polymerization, (ii) Anionic polymerization, (iii) Cationic polymerization, Kinetics of free radical chain polymerization, Degree of Polymerization, Molar mass of polymer, Number Average Molar Mass, Weight average Molar Mass, Determination of molar mass of Macro molecules, Viscosity Method, Light Scattering method. **Numerical**	**16**	**40%**

Reference Books:

1) Principal of Physical Chemistry by Puri, Sharma & Pathania.

2) Physical Chemistry by Atkins.

3) Advance Physical Chemistry by Gurdeep Raj.

4) Chemical Thermodynamics by R.P. Rastogi & R.R. Mishra.

5) Physical Chemistry (Question and Answer) by R.N. Madan, G.D. Tuli & S.Chand.

6) Physical Chemistry by W.J. Moore, 4th edition, Orient Longmans 1969.

7) Essentials of Physical Chemistry by B.S. Bahal, Arun Bahal & G.D. Tuli.

Course Outcomes: At the end of the course, students shall be able to

CO1	Student after learning this course can be introduced about the fundamentals of statistical thermodynamics.
CO2	Learn the polymerization reaction with examples.
CO3	Understand the Chemical Cell: Without Transference with Transference.
CO4	Study the physical chemistry of macromolecules.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**			
CO2	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**			
CO3	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**2**			
CO4	**3**	**2**	**1**	**2**	**1**	**2**	**1**	**1**	**2**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**2**
CO2													**2**	**2**
CO3													**3**	**2**
CO4													**2**	**2**
CO5														

Subject Code: BCHE504UDSC **Semester: V**
Subject Name: ANALYTICAL CHEMISTRY **Faculty Name/s:**

Credits: 03 **L-T-P-J: 3-0-0-0**

Unit	Content	Hrs.	Weightage
1	**^{1}H NMR Spectroscopy** Introduction, Principle of NMR spectroscopy, Equivalent & Non- equivalent proton, Shielding & De-shielding, Chemical Shift & Molecular Structure, Spin-Spin Splitting & Coupling constant, Application of NMR, Interpretation of organic molecules i.e. Examples, Toluene, Ethanol, Acetone, Ethyl bromide, Methoxy benzene, Phenitol, etc.	**13**	**33%**
2	**Symmetry of molecules** Symmetry elements & symmetry operations, Multiplications of symmetry operations, Multiplication table for C_{2v}, C_{3v}, C_{2h} point groups only, Classification of schoonflies point groups, Symmetry & Optical activity, Symmetry property of orbital's for , C_{3v}, C_{2h} point groups.	**17**	**34%**
3	**Acid- Base titration** Construction of titration curves, Feasibility of titration of poly protic acid, Analysis of acid & base mixture, Differential titration of alkalis, Gran's plot, Buffers, Buffer level, Buffer range & Buffer capacity.	**15**	**33%**

Reference Books:

1) Chemical application of group theory by F.A. Cotton.
2) Application of group theory to chemistry by Bhattacharya.
3) Symmetry in chemistry by Jafle & Orchin.

4) Advance inorganic chemistry by Cotton & Wilkinson.

5) Basic Principles of spectroscopy by R.Chand.

6) Spectroscopy organic compounds VIth edition by P.S. Kalsi.

7) Organic Chemistry by Morrison & Boyd.

8) Application of absorption spectroscopy of organic compounds by John R. Dyer.

9) Spectrometric Identification of organic compounds IVth edition by Silverstain, Bassler & Morrill.

10) Analytical Chemistry by G.D. Christian.

11) Principles of Analytical Chemistry by J.H. Kennedy.

12) Organic spectroscopy by V.R. Dani.

Course Outcomes: At the end of the course, students shall be able to

CO1	Student after learning this course can seek employment in areas of Agriculture, farms, Educational Institutes etc. as Junior Scientist, Assistant Professor, Content Developer, and Researcher etc.
CO2	The student will be able to relate different kind of spectroscopy studies and symmetry classification of various chemicals. They will be able to explain acid-base titration of a various groups.
CO3	Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.
CO4	Apply the various procedures and techniques for the experiments.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**2**			
CO2	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**			
CO3	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**			
CO4	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**2**	**2**
CO3													**3**	**3**

CO4												**3**	**3**
CO5													

Subject Code: BCHE501SE **Semester: V**
Subject Name: SYNTHETIC DYES **Faculty Name/s:**

Credits: 02 **L-T-P-J: 2-0-0-0**

Unit	Content	Hrs.	Weightage
1	**Introduction of Dyes & its Classification** Introduction, Chromospheres, Chromogens, Oxochromes, Bathochromic Shieft, Hypsochromic Shieft, Differencebetween Dyes and Pigments, Classification of Dyes- According to Constitution and method of colouring the fibres, Optical Brighteners.	15	50%
2	**Dye Synthesis & it's uses** Congo red, Eosin, Alizarin, crystal Violet, Indigo, Sefronine-T, Methylene Blue, Eriochrome Black-T, Rhodamine, Rosanilin.	15	50%

Reference Books:

1) Synthetic Dyes by Venkatramanan.
2) Synthetic Dyes by G.R. Chatwal.
3) Synthetic Dyes and Drugs by O.P. Agrawal.
4) Synthetic Dyes by O.D. Tyagi & M.Yadav.
5) Sanshleshit Rangako, Granth Nirman Board.

Course Outcomes: At the end of the course, students shall be able to

CO1	Student after learning this course can be introduced about the Dyes & its Classification
CO2	Learn the difference between Dyes and Pigments
CO3	Understand the Chromospheres and Chromogens
CO4	Study the dye Synthesis & it's uses

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**			
CO2	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**2**			
CO3	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**2**			
CO4	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**2**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**3**	**2**
CO3													**3**	**2**
CO4													**3**	**3**
CO5														

Subject Code: BCHE502SE **Semester: V**
Subject Name: PHARMACEUTICAL CHEMISTRY Faculty Name/s:

Credits: 02 **L-T-P-J: 2-0-0-0**

Unit	Content	Hrs.	Weightage
1	**Introduction of Pharmaceutical Chemistry & pharmacopeia** Source of impurities, Limit tests for iron, arsenic, Lead, heavy metals, chloride and sulphate. Essential and trace elements, Transition elements and their compounds of pharmaceutical importance: Iron and haematinics,mineral supplements.	15	50%
2	**An outline of methods of preparation, properties (Chemical & Physical), purity, identity assay principleof the following class of compounds:** Gases & Vapours: Oxygen, Anesthetics, Complexing and Chelating agents used in therapy, Dental products: Dentifrices, Anti-caries agents, Antidotes, Sclerosing agents, Inhalants, Anesthetics and respiratory stimulants.	15	50%

Reference Books:

1) Pharmaceutical Inorganic Chemistry Volume-I by G.R. Chatwal.
2) Textbook of Pharmaceutical Chemistry, Oxford University Press, 8th Edition by Bently and Driver.
3) Practical Pharmaceutical Chemistry edited by A.H. Beckett.

Course Outcomes: At the end of the course, students shall be able to

CO1	Student after learning this course can be introduced about the Pharmaceutical chemistry
CO2	Learn about preparation, properties (Chemical & Physical), purity, identity assay
CO3	Understand the principle of pharma drug
CO4	Study the biologically active drugs.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**			
CO2	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**2**			
CO3	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**2**			
CO4	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**2**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**3**	**2**
CO3													**3**	**2**
CO4													**3**	**3**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDDHPUR			
Programme Code	**BCHE**	**Programme Name**	B.Sc. Chemistry
Course Code	BCHE501PRA	**Semester**	V
CHEMISTRY PRACTICALS			
Course type :	Practical	**Total Credit :**	06

Sr. No.	Practical Exercise
1.	**Inorganic Chemistry** **(A) Alloy** 1) Brass alloy---------- Zn (Gravimetric) and Cu (Volumetric) 2) German silver alloy----------Ni (Gravimetric) and Cu (Volumetric) 3) Bronze alloy---------- Sn (Gravimetric) and Cu (Volumetric) **(B) Synthesis by Convention Method** 1) Ferrous Sulphate or Green vitriol ($FeSO_4.7H_2O$) 2) Sodium cobaltinitrate $Na_3[Co(No_2)_6]$ 3) Tetra amine cupric sulphate 4) Hexa thiourea plumbous nitrate 5) Cuprous chloride

2.	**Organic Chemistry** **Qualitative Analysis (Minimum 08)** Analysis of an organic mixture containing two components using water, $NaHCO_3$, NaOH, HCl for Separation /or using distillation process for separation and identification with the Preparation of Suitable derivatives. Soluble Components:- Oxalic Acid, Succinic Acid, Resorcinol, Urea, ThioureaSeparation of two components from Organic Mixture Such as… Solid-Solid ---------- Mixture Solid- Liquid ---------- Mixture Liquid-Liquid ---------- Mixture [Liquid component must be neutral in nature]

3.	**Physical Chemistry** **[A] Instruments: (Minimum 05)** 1. To determine normality and amount of HCl and CH_3COOH in the given solution by Conductometric titration against 0.2N (exact) NaOH solution. 2. To determine the solubility product and solubility of sparingly soluble salts $PbSO_4$ by Conductometry. 3. To determine Normality and amount of each acid in the given mixture of HCl +CH_3COOH by pH metrically. 4. To determine the strength of strong and weak acid in a given mixture by Potentiometric titration using 0.1 N NaOH. 5. To determine the concentration of Nickel in the given solution by Colorimetricestimation. 6. To determine the concentration of unknown solution from given $KMnO_4$ solution by Colorimetric. **[B] Kinetics & Distributions: (Minimum 03)** 7. To determine the order of the reaction between $K_2S_2O_8$ and KI. 8. To determine the order of the reaction between H_2O_2 and HI. 9. To determine the distribution coefficient of Iodine between $CCl_4/CHCl_3$ and water at a given temperature. 10. To study the distribution of Benzoic acid between Benzene and water at roomtemperature and prove the dimidiation of Benzoic acid in Benzene.

Reference Books:

1) Vogel's Textbook of Practical Organic Chemistry by B.S.Furniss, A.J. Hannaford, P.W. G.Smith, A.R. Tatchell, 5th Edition.

2) Comprehensive Practical Organic Chemistry- Preparation and Quantitative Analysis by V.K.Ahluwalia and Renu Aggarwal.

3) Comprehensive Practical Organic Chemistry- Qualitative Analysis by V.K. Ahluwalia andSunita Dhingra.

Subject Code: BCHE601UDSC **Semester: VI**

Subject Name: INORGANIC CHEMISTRY **Faculty Name/s:**

Credits: 03 **L-T-P-J: 3-0-0-0**

Unit	Content	Hrs.	Weightage
1	**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: $Ni(CO)_4$, $Fe(CO)_5$, $Cr(CO)_6$, $Fe_2(CO)_9$, $CO_2(CO)_8$, $Mn_2(CO)_{10}$, $Fe_3(CO)_{12}$, Calculation of EAN of metal atom in metal carbonyl, Classification of metal nitrosyl.	**16**	**40%**
2	**Bio –Inorganic Chemistry** Introduction, Essential elements, Trace elements, Metal Porphyrine, Study of haemoglobin and myoglobin, Nitrogen fixation: in Vivo and in Vitro.	**14**	**30%**
3	**Valencey** Variation method, Secular equation, Stability of H^{2+} ion, M.O. Approach, stability of H2 molecule, V.B. approach, Classical interaction energy, Representation of wave function for SP, SP^2 and SP^3 hybrid orbitals, Bond angle and Bond strength, M.O. treatment of Oh molecules, Quantum mechanical representation of Pauli's exclusion principle.	**15**	**30%**

Reference Books:

1) Inorganic Chemistry by S. Chand.
2) Advance Inorganic Chemistry by Satya Prakash Volume-II (S.Chand).
3) Concise Inorganic Chemistry by J.D.Lee.
4) Metallic Corrosion by M.N. Desai
5) Advance Inorganic Chemistry by J.E. Huhee.

Course Outcomes: At the end of the course, students shall be able to

CO1	To develop interest among students in various branches of inorganic chemistry.
CO2	To impart essential theoretical knowledge on atomic structure, periodic properties and chemical bonding.
CO3	This will give the students a basic understanding of nuclear chemistry, Bioinorganic Compounds.

CO4	This paper also gives elementary ideas on metal complexes.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**			
CO2	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**			
CO3	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**2**			
CO4	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**1**	**2**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**2**	**2**
CO3													**2**	**2**
CO4													**2**	**2**
CO5														

Subject Code: BCHE602UDSC **Semester: VI**
Subject Name: ORGANIC CHEMISTRY **Faculty Name/s:**

Credits: 03 **L-T-P-J: 3-0-0-0**

Unit	Content	Hrs.	Weightage
1	**Electrophillic and free radical addition reaction** Addition to carbon carbon double bond, Markovnikov's rule, Electrophillic addition Orientation, Reactivity, Rearrangement, Dimerization, Alkylation, Peroxide effect (Anti Markovnikov'srule), Free radical addition, mechanism of peroxide initiated addition of HBr, Syn and anti addition mechanism for addition of halogens, Electrophillic addition to conjugated dienes (1:2 v/s 1:4 addition), Free radical addition to conjugated dienes, reactivity.	17	40%
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.	14	30%
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.	14	30%

Reference Books:

1) Organic Chemistry by Morrison and Boyd 5th Edition.
2) Advance Organic Chemistry by R.K. Bansal.
3) Organic Chemistry by I. L. Finar Volume 1 & 2 5th Edition.

Course Outcomes: At the end of the course, students shall be able to

CO1	To study the fundamentals of terpenoids, alkaloids, vitamins, lipids and steroids.
CO2	To impart the student's thorough idea in the chemistry of enzymes, amino acids, proteins and nucleic acids.
CO3	To have an elementary idea of supramolecular chemistry.
CO4	Identification of organic compounds using spectroscopy.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**2**			
CO2	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**			
CO3	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**			
CO4	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**1**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**2**	**2**
CO3													**2**	**2**
CO4													**2**	**3**
CO5														

Subject Code: BCHE603UDSC **Semester: VI**
Subject Name: PHYSICAL CHEMISTRY **Faculty Name/s:**

Credits: 03 **L-T-P-J: 3-0-0-0**

Unit	Content	Hrs.	Weightage
1	**Thermodynamics** Zeroth Law of thermodynamics, 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**	13	33%
2	**Photochemistry** Introduction of Photochemistry, Thermal and Photochemicalreactions and its difference, Absorption, The Law of Absorption, Lambert-Beer Law, Laws of Photochemistry- (i) Grotthuss-Draper Law (ii) Stark-Einstein Law, Quantum Yield or Quantum Efficiency, Reason of High and Low quantum yield, Types of Photochemical Reaction- (i) Photosensitized reaction (ii) Photochemical Equilibrium, Qualitative Description of Fluorescence, Phosphorescence and Chemiluminescence, Flash Photolysis. **Numerical**	17	35%
3	**Chemical Kinetics** Arrhenius Equation, Concept of Activation energy, Theories of reaction rate- (i) Collision theory (ii) Transition state theory, Comparison of Collision and transition state theory, Theories of Unimolecular reaction, Lindemann's theory, Trimolecular reaction, Trautz's law, Primary and Secondary salt effect. **Numerical**	15	32%

Reference Books:

1) Principal of Physical Chemistry by Puri, Sharma & Pathania.
2) Physical Chemistry by Atkins.
3) Advance Physical Chemistry by Gurdeep Raj.
4) Chemical Thermodynamics by R.P. Rastogi & R.R. Mishra.
5) Physical Chemistry (Question and Answer) by R.N. Madan, G.D. Tuli & S.Chand.
6) Physical Chemistry by W.J. Moore, 4th edition, Orient Longmans 1969.
7) Essentials of Physical Chemistry by B.S. Bahal, Arun Bahal & G.D. Tuli.

Course Outcomes: At the end of the course, students shall be able to

CO1	Student after learning this course can be introduced about the thermal and photochemical reactions and its difference, absorption.
CO2	Learn the Nernst heat theorem.
CO3	Understand the Concept of activation energy.
CO4	To derive some thermochemical equations and kinetic equations. To study phase diagrams and elementary idea of catalysis.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**			
CO2	**3**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**			
CO3	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**			
CO4	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**2**	**2**
CO3													**2**	**1**
CO4													**2**	**1**
CO5														

Subject Code: BCHE604UDSC **Semester: VI**
Subject Name: ANALYTICAL CHEMISTRY **Faculty Name/s:**

Credits: 03 **L-T-P-J: 3-0-0-0**

Unit	Content	Hrs.	Weightage
1	**IR Spectra & Numerical based on UV, IR and NMR Spectra** **(A) Infrared spectroscopy** Molecular vibrations (Fundamental vibrations of AX_2 type molecules), Characteristics of IR spectroscopy, Sample techniques, Fingerprint zone, Effect of IR in geometrical isomerism, IR spectra & H-bonding, Factor affecting on >C=0 group frequencies, Differentiate two compounds by the IR frequencies. **(B) Problems pertaining to the structure elucidation of organic Compounds using UV, IR & NMR spectroscopic techniques (one out of two)**	**17**	**40%**
2	**Chromatography** Introduction, Type of Chromatography, Paper Chromatography, Thin- layer Chromatography, Ion Exchange Chromatography, Van- deemter equation, Examples, HPLC Principle, Application ofChromatography.	**14**	**30%**
3	**Term Symbol & Spectra of d^1-d^9 Octahedral Complexes** **(A) Term Symbol** L-S Coupling, 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, Oral 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**	**30%**

Reference Books:

1) Chemical application of group theory by F.A. Cotton.
2) Application of group theory to chemistry by Bhattacharya.
3) Symmetry in chemistry by Jafle & Orchin.
4) Advance inorganic chemistry by Cotton & Wilkinson.
5) Basic Principles of spectroscopy by R.Chand.
6) Spectroscopy organic compounds VIth edition by P.S. Kalsi.
7) Organic Chemistry by Morrison & Boyd.
8) Application of absorption spectroscopy of organic compounds by John R. Dyer.
9) Spectrometric Identification of organic compounds IVth edition by Silverstain, Bassler &Morrill.
10) Analytical Chemistry by G.D. Christian.
11) Principles of Analytical Chemistry by J.H. Kennedy.
12) Organic spectroscopy by V.R. Dani.

Course Outcomes: At the end of the course, students shall be able to

CO1	Student after learning this course can seek employment in areas of Agriculture, farms, Educational Institutes etc. as Junior Scientist, Assistant Professor, and Researcher etc.
CO2	The student will be able to relate different kind of spectroscopy studies and symmetry classification of various chemicals. They will be able to explain acid-base titration of a various groups
CO3	Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.
CO4	Apply the various procedures and techniques for the experiments.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**2**	**1**	**1**	**2**	**2**	**1**			
CO2	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**1**	**2**			
CO3	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**1**			
CO4	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**2**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1													**3**	**3**
CO2													**3**	**3**
CO3													**2**	**3**
CO4													**2**	**3**
CO5														

Subject Code: BCHE601SE **Semester: VI**
Subject Name: POLYMER CHEMISTRY **Faculty Name/s:**

Credits: 02 **L-T-P-J: 2-0-0-0**

Unit	Content	Hrs.	Weightage
1	**Polymers – I** Introduction, Classification of polymers, Chain growth of polymerization- Introduction, Mechanism and Kinetics of free radical, Cationic and Anionic Polymerization, Mechanism and Kinetics of polycondensation.	15	50%
2	**Polymers – II** Polymerization techniques, Molecular weight and Degree of Polymerization, Concept of Averages- (i) Number average molecular weight, (ii) Weight average molecular weight, (iii) Viscosity average molecular weight, Poly dispersity and molecular weight distribution, Membrane Osmometry, Viscometry and Light Scattering.	15	50%

Reference Books:

1) Principles of polymers science by P. Bahadur and N. V. Sastry. (2nd Edition)
2) Polymer science by V.R. Gowariker, N.V. vashwanathan and Jaydev Shreedhar.

Course Outcomes: At the end of the course, students shall be able to

CO1	Student after learning this course can be introduced about the Polymerization techniques
CO2	Learn the Mechanism and Kinetics of polycondensation
CO3	Understand the Concept of Averages
CO4	Study the theories of Polydispersity and molecular weight distribution

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**2**			
CO2	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**			
CO3	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**			
CO4	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**			

CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**3**	**2**
CO3													**3**	**2**
CO4													**3**	**2**
CO5														

Subject Code: BCHE602SE **Semester: VI**
Subject Name: FOOD ADDITIVES **Faculty Name/s:**

Credits: 02 **L-T-P-J: 2-0-0-0**

Unit	Content	Hrs.	Weightage
1	**Introduction of Food Additives & its Classification** Introduction, Classification of Food additives, Food additives and functionalities, Food additives regulations, Assessment of Food additives, Functional Classes of Food additives.	15	50%
2	**Mechanism and Chemistry of Food additives** Flavoring agents, Emulsifiers, acidulants, Antioxidants, thickeners, Sweeteners, Food Colors, Preservatives, Aroma, List of Authorized Food additives, Risk benefit ratio.	15	50%

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) Food and Safety authority of Ireland Published by guidance of Food Additives 2010.

Course Outcomes: At the end of the course, students shall be able to

CO1	Student after learning this course can be introduced about Classification of Food additives, Food additives and functionalities,
CO2	Learn the Food additives regulations, Assessment of Food additives, Functional Classes of Food additives.
CO3	Understand the Flavoring agents, Emulsifiers, acidulants, Antioxidants, thickeners, Sweeteners, Food Colors, Preservatives, Aroma,
CO4	Study the theories of Authorized Food additives, Risk benefit ratio.

CO-PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**2**			
CO2	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**			
CO3	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**			
CO4	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**			
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**3**	**2**
CO3													**3**	**2**
CO4													**3**	**2**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDDHPUR			
Programme Code	**BCHE**	**Programme Name**	B.Sc. Chemistry
Course Code	BCHE601PRA	**Semester**	VI
CHEMISTRY PRACTICALS			
Course type :	Practical	**Total Credit :**	06

Sr. No	Practical Exercise
1.	**Inorganic Chemistry** Qualitative analysis (Minimum 8) 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 shall be no deduction of marks for reporting wrong radicals.
2.	**Organic Chemistry** **(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 [Liquid component must beneutral in nature.]

3.	**Physical Chemistry** **[A] [Instruments]: (Minimum 05)** 1) To determine concentration of the given Iodide solution by Potentiometric titrationagainst 0.1N $KMnO_4$ solution. 2) To determine formal redox potential of Fe^{+2}/Fe^{+3} by Potentiometry. 3) To determine the concentration of the **nitrite** in the given solution by Colorimetricestimation method. 4) To determine the concentration of unknown solution from given $K_2Cr_2O_7$ byColorimetric. 5) To determine the Solubility product and solubility of sparingly soluble salt of $BaSO_4$by Conductometry. 6) To determine the strength of strong and weak base in a given mixture using a pHmeter. **[B] Kinetics, Adsorption & Polymer (Minimum 03)** 7) To study the reaction between $KBrO_3$ and KI at two different temperature andcalculate the temperature coefficient and the energy of activation. 8) To study the absorption of Acetic Acid on Charcoal and prove the validity offreundlich equation. 9) To determination of molecular weight of high polymer (i.e. polystyrene) byViscosity measurement. 10) To study the rate constant of the reaction between $K_2S_2O_8$ and KI and study theinfluence of ionic strength on the rate constant.

Reference Books:

1) Vogel's Textbook of Practical Organic Chemistry by B.S.Furniss, A.J. Hannaford, P.W. G.Smith, A.R. Tatchell, 5th Edition.

2) Comprehensive Practical Organic Chemistry- Preparation and Quantitative Analysis by V.K.Ahluwalia and Renu Aggarwal.

3) Comprehensive Practical Organic Chemistry- Qualitative Analysis by V.K. Ahluwalia andSunita Dhingra.