PROGRAM / COURSE FRAME

U.G. DEPARTMENT OF CHEMISTRY (AIDED)

Program for Choice Based Credit System - 2015 – 2016

SEM	Part	Course No.	Course Title	Hours	Credits	Marks	
1	I	TAM/FRE/HIN		3	2	30	
1	II	ENG		3	2	30	
1	IIIC	CHE 1521	Physical Chemistry – I	5	5	75	
1	IIIC	CHE 1513	Inorganic Chemistry – I	5	5	75	
1	IIIC	CHE 1331	Inorganic Quantitative Analysis	3	3	45	
1	IIIS	PHY	Physics	5	4	60	
1	IV	CHE 1261/NME I	Chemistry in Everyday life	3	2	30	
1	IV	CHE 1271/ LS I	Cosmetics and Consumer Products	3	2	30	
1	V		NSS/NCN/NCC/PED/SLP				
			Total	**30**	**25**	**405**	
2	I	TAM/FRE/HIN		3	2	30	
2	II	ENG		3	2	30	
2	IIIC	CHE 1522	Organic Chemistry –I	5	5	75	
2	IIIC	CHE 1514	Inorganic Chemistry – II	5	5	75	
2	IIIC	CHE 1332	Organic Analysis and Preparation	3	3	45	
2	IIIS	PHY	Physics	5	4	60	
2	IV	CHE 1262/NMEII	Food Chemistry	3	2	30	
2	IV	CHE 1272/LS II	Chemistry in Crime Investigation	3	2	30	
2	V		NSS/NCN/NCC/PED/SLP				
			Total	**30**	**25**	**405**	
3	I	TAM/FRE/HIN		3	2	30	
3	II	ENG		3	2	30	
3	IIIC	CHE 2521	Organic Chemistry – II	5	5	75	
3	IIIC	CHE 2513	Inorganic Chemistry – III	5	5	75	
3	IIIC	CHE 2515	Physical Chemistry – II	5	5	75	
3	IIIC	CHE 2431	Inorganic Qualitative Analysis	4	4	60	
3	IIIS	MAT/BOT	Maths/Botany	5	4	60	
3	V		NSS/NCN/NCC/PED/SLP				
			Total	**30**	**27**	**435**	
4	I	TAM/FRE/HIN		3	2	30	
4	II	ENG		3	2	30	
4	IIIC	CHE 2522	Organic Chemistry – III	5	5	75	
4	IIIC	CHE 2524	Inorganic Chemistry – IV	5	5	75	
4	IIIC	CHE 2516	Physical Chemistry – III	5	5	75	
4	IIIC	CHE 2432	Organic Estimation and Gravimetric Analysis	4	4	60	
4	IIIS	MAT/ BOT	Maths/Botany	5	4	60	
4	V		NSS/NCN/NCC/PED/SLP				
			Total	**30**	**27**	**435**	
5	IIIC	CHE 3611	Organic Chemistry – IV	6	6	90	
5	IIIC	CHE 3613	Inorganic Chemistry – V	6	6	90	
5	IIIC	CHE 3615	Physical Chemistry – IV	6	6	90	
5	IIIC	CHE 3531	Physical Chemistry Lab	5	5	75	
5	III	CHE 3200	Environmental Chemistry	4	2	30	
5	IV	CHE 3215/ LS III	Medicinal Chemistry	3	2	30	
			Total	30	27	405	
6	IIIC	CHE 3612	Organic Chemistry – V	6	6	90	
6	IIIC	CHE 3614	Applied Chemistry	6	6	90	
6	IIIC	CHE 3616	Physical Chemistry – V	6	6	90	
6	IIIC	CHE 3534	Project	5	5	75	
6	IV	VAL	Value Education	4	2	30	
6	IV	CHE 3216/ LS IV	Dairy and Dairy products	3	2	30	
			Total	**30**	**27**	**405**	
			Grand Total	**180**	**158**	**2430**	

MAJOR SUPPORTIVES COURSES

Sem	Part	Old course code	Course code	Course Title	Hours	Credit	Marks
1	IIIS	-	CHE 1461	Chemistry for Botanist - 1	5	4	60
1	IIIS	CHE 1463	CHE 1381	Chemistry for Botanist - I	3	3	45
1	IIIS		CHE 1183	Chemistry lab for Botanist-I	2	1	15
2	IIIS	CHE 1464	CHE 1382	Chemistry for Botanist-II	3	3	45
2	IIIS		CHE 1184	Chemistry lab for Botanist-II	2	1	15
3	IIIS	CHE 2441	CHE 2381	Chemistry for Physicist-I	3	3	45
3	IIIS		CHE 2181	Chemistry lab for Physicist-I	2	1	15
3	IIIS	CHE 2413	CHE 2383	Chemistry for Zoologist-I	3	3	45
3	IIIS		CHE 2183	Chemistry lab for Zoologist-I	2	1	15
4	IIIS	CHE 2442	CHE 2382	Chemistry for Physicist-II	3	3	45
4	IIIS		CHE 2182	Chemistry lab for Physicist-II	2	1	15
4	IIIS	CHE 2414	CHE 2384	Chemistry for Zoologist-II	3	3	45
4	IIIS		CHE 2184	Chemistry lab for Zoologist-II	2	1	15

NON MAJOR ELECTIVES

	Sem	Part	Course code	Course Title	Hours	Credit	Marks
NME I	1	IV	CHE 1261	Chemistry in Everyday Life	3	2	30
NME II	2	IV	CHE 1262	Food Chemistry	3	2	30

LIFE SKILL COURSES

	Sem	Part	Course code	Course Title	Hours	Credit	Marks
LS I	1	IV	CHE 1271	Cosmetics and Consumer Products	3	2	30
LS II	2	IV	CHE 1272	Chemistry in Crime Investigation	3	2	30
LS III	5	IV	CHE 3215	Medicinal Chemistry	3	2	30
LS IV	6	IV	CHE 3216	Dairy and Dairy Products	3	2	30

THE AMERICAN COLLEGE, MADURAI

PROGRAM / COURSE FRAME

U.G. DEPARTMENT OF CHEMISTRY (SF)

Program for Choice Based Credit System - 2015 – 2016

SEM	Part	Course No.	Course Title	Hrs	Credits	Marks	
1	I	TAM/FRE/HIN		3	2	30	
1	II	ENS 1201	Conversational Skills	3	2	30	
1	IIIC	CHS 1521	Physical Chemistry – I	5	5	75	
1	IIIC	CHS 1513	Inorganic Chemistry – I	5	5	75	
1	IIIC	CHS 1331	Inorganic Quantitative Analysis	3	3	45	
1	IIIS	MAS/ BCH	Maths/Biochemistry	5	4	60	
1	IV	CHS 1251/NME I	Dairy Chemistry	3	2	30	
1	IV	CHS 1271/ LS I	Cosmetics and Consumer Products	3	2	30	
1	V		NSS/NCN/NCC/PED/SLP				
			Total	**30**	**25**	**405**	
2	I	TAM/FRE/HIN		3	2	30	
2	II	ENS 1202	Reading & Writing Skills	3	2	30	
2	IIIC	CHS 1522	Organic Chemistry –II	5	5	75	
2	IIIC	CHS 1514	Inorganic Chemistry – II	5	5	75	
2	IIIC	CHS 1332	Organic Analysis and Preparation	3	3	45	
2	IIIS	MAS/ BCH	Maths/Biochemistry	5	4	60	
2	IV	CHS 1252/NME II	Chemistry in Today's World	3	2	30	
2	IV	CHS 1272/LS II	Chemistry in Crime Investigation	3	2	30	
2	V		NSS/NCN/NCC/PED/SLP				
			Total	**30**	**25**	**405**	
3	I	TAM/FRE/HIN		3	2	30	
3	II	ENS 2201	Study Skills	3	2	30	
3	IIIC	CHS 2521	Organic Chemistry – II	5	5	75	
3	IIIC	CHS 2513	Inorganic Chemistry – III	5	5	75	
3	IIIC	CHS 2515	Physical Chemistry – II	5	5	75	
3	IIIC	CHS 2431	Inorganic Qualitative Analysis	4	4	60	
3	IIIS	PHS	Physics	5	4	60	
3	V		NSS/NCN/NCC/PED/SLP				
			Total	**30**	**27**	**435**	
4	I	TAM/FRE/HIN		3	2	30	
4	II	ENS 2202	Career Skills	3	2	30	
4	IIIC	CHS 2522	Organic Chemistry – III	5	5	75	
4	IIIC	CHS 2524	Inorganic Chemistry – IV	5	5	75	
4	IIIC	CHS 2516	Physical Chemistry – III	5	5	75	
4	IIIC	CHS 2432	Organic Estimation & Gravimetric Analysis	4	4	60	
4	IIIS	PHS	Physics	5	4	60	
4	V		NSS/NCN/NCC/PED/SLP				
			Total	**30**	**27**	**435**	
5	IIIC	CHS 3611	Organic Chemistry – IV	6	6	90	
5	IIIC	CHS 3613	Inorganic Chemistry – V	6	6	90	
5	IIIC	CHS 3615	Physical Chemistry – IV	6	6	90	
5	IIIC	CHS 3531	Physical Chemistry Lab	5	5	75	
5	III	CHS 3200	Environmental Chemistry	4	2	30	
5	IV	CHS 3215/ LS III	Medicinal Chemistry	3	2	30	
			Total	30	27	405	
6	IIIC	CHS 3612	Organic Chemistry – V	6	6	90	
6	IIIC	CHS 3614	Applied Chemistry	6	6	90	
6	IIIC	CHS 3616	Physical Chemistry – V	6	6	90	
6	IIIC	CHS 3534	Project	5	5	75	
6	IV	VAL	Value Education	4	2	30	
6	IV	CHS 3218/ LS IV	Food processing and preservation	3	2	30	
			Total	**30**	**27**	**405**	
			Grand Total	**180**	**158**	**2430**	

MAJOR SUPPORTIVES COURSES

Sem	Part	Old course code	Course code	Course Title	Hours	Credit	Marks
1	IIIS	CHS	CHS 1371	Chemistry for Bio-Chemistry - I	3	3	45
1	IIIS	1425	CHS 1173	Chemistry lab for Bio-Chemistry I	2	1	15
2	IIIS	CHS	CHS 1372	Chemistry for Bio-Chemistry -II	3	3	45
2	IIIS	1426	CHS 1174	Chemistry lab for Bio-Chemistry -II	2	1	15
3	IIIS	CHS	CHS 2381	Chemistry for Physicist-I	3	3	45
3	IIIS	2411	CHS 2181	Chemistry lab for Physicist-I	2	1	15
4	IIIS	CHS	CHS 2382	Chemistry for Physicist-II	3	3	45
4	IIIS	2412	CHS 2182	Chemistry lab for Physicist-II	2	1	15

NON MAJOR ELECTIVES

	Sem	Part	Course code	Course Title	Hours	Credit	Marks
NME I	1	IV	CHS 1251	Dairy Chemistry	3	2	30
NME II	2	IV	CHS 1252	Chemistry in Today’s World	3	2	30

LIFE SKILL COURSES

	Sem	Part	Course code	Course Title	Hours	Credit	Marks
LS I	1	IV	CHS 1271	Cosmetics and Consumer Products	3	2	30
LS II	2	IV	CHS 1272	Chemistry in Crime Investigation	3	2	30
LS III	5	IV	CHS 3215	Medicinal Chemistry	3	2	30
LS IV	6	IV	CHS 3218	Food processing and preservation	3	2	30

PSO- UG Chemistry

At the end of the programme, students will be able to:

PSO 1: demonstrate knowledge and understanding of the principles and theories related to organic, inorganic, physical, analytical and environmental chemistry.

PSO 2: apply chemistry knowledge to solve the problems in various areas.

PSO 3: identify and analyze the problem and plan strategies for them.

PSO 4: acquire skills to interpret chemical information.

PSO 5: developing skills to effectively communicate scientific ideas related to chemistry.

PSO 6: acquire skills in safe handling of apparatus and chemicals including any specific hazards associated with it.

PSO 7: develop skills to carry out experiments in physical, organic and inorganic areas.

PSO 8: develop skills in the operation of standard chemical instruments and softwares.

PSO 9: apply knowledge in chemistry to go for higher studies, clear competitive exams, become employable or lead as an entrepreneur.

PSO 10: develop skills to communicate their ideas with regard to impacts of chemistry on environment and society.

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

Course	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**	**PSO 9**	**PSO 10**
CHE 1521/CHS 1521	✓	✓	✓	✓	✓				✓	✓
CHE 1513/CHS 1513	✓	✓	✓	✓	✓				✓	✓
CHE 1331/CHS 1331			✓			✓	✓	✓	✓	
CHS1371	✓	✓								
CHE 1381	✓	✓	✓						✓	
CHE 1183	✓	✓			✓	✓			✓	✓
CHS 1173	✓	✓			✓	✓			✓	✓
CHE 1261	✓	✓	✓		✓				✓	✓
CHS 1251	✓	✓	✓		✓				✓	✓
CHE 1271/CHS 1271	✓	✓	✓		✓				✓	✓
CHE 1522/CHS 1522	✓	✓		✓	✓				✓	✓
CHE 1514/CHS 1514	✓	✓		✓	✓				✓	✓
CHE 1332/CHS 1332	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CHS1372	✓	✓	✓							
CHE 1382	✓	✓							✓	✓
CHE 1184	✓	✓			✓	✓			✓	✓
CHS 1174	✓	✓			✓	✓			✓	✓
CHE 1262	✓	✓	✓		✓				✓	✓

CHS 1252	✓	✓	✓		✓				✓	✓
CHE 1272/CHS 1272	✓	✓	✓		✓				✓	✓
CHE 2521/CHS 2521	✓	✓		✓	✓				✓	✓
CHE 2513/CHS 2513	✓	✓	✓	✓	✓				✓	✓
CHE 2515/CHS 2515	✓	✓	✓	✓	✓				✓	✓
CHE 2431/CHS 2431			✓			✓	✓		✓	
CHE 2381 /CHS 2381	✓	✓								
CHE 2383	✓	✓								
CHE 2181/CHS 2181	✓	✓			✓	✓			✓	✓
CHE 2183	✓	✓			✓	✓			✓	✓
CHE 2522/CHS 2522	✓	✓		✓	✓				✓	✓
CHE 2524/CHS 2524	✓	✓	✓	✓	✓				✓	✓
CHE 2516/CHS 2516	✓	✓	✓	✓	✓				✓	✓
CHE 2432/CHS 2432			✓			✓	✓	✓	✓	
CHE 2382/CHS 2382	✓	✓	✓							
CHE 2384	✓	✓								
CHE 2182/ CHS 2182	✓	✓			✓	✓			✓	✓
CHE 2184	✓	✓			✓	✓			✓	✓
CHE3611 /CHS 3611	✓	✓		✓	✓				✓	✓
CHE3613/CHS 3613	✓	✓	✓	✓	✓				✓	✓
CHE3615/CHS 3615	✓	✓	✓	✓	✓				✓	✓
CHE3200/CHS3200	✓	✓	✓							
CHE3531/CHS3531	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CHE3215/CHS3215	✓	✓	✓		✓				✓	✓
CHE3612 /CHS 3612	✓	✓		✓	✓				✓	✓
CHE3614/CHS 3614	✓	✓			✓				✓	✓
CHE 3616/CHS 3616	✓	✓	✓	✓	✓				✓	✓
CHE3534/CHS 3534	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CHE 3216	✓	✓	✓		✓				✓	✓
CHS 3218	✓	✓	✓		✓				✓	✓

Mapping of PO and PSO – DEPARTMENT OF CHEMISTRY (UG)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
PSO1	✓									
PSO2	✓									
PSO3		✓								
PSO4		✓								
PSO5			✓		✓		✓			
PSO6					✓					
PSO7						✓				
PSO8						✓				
PSO9				✓	✓	✓		✓	✓	✓
PSO10			✓		✓				✓	✓

Curriculum

for

First Year B.Sc Chemistry (AIDED & SF) Programme

(For those who were admitted from the academic year 2015-2016 onwards)

SEMESTER I

Since 1881

Undergraduate Department of Chemistry

The American College

(An Autonomous Institution Affiliated to Madurai Kamaraj University)

Madurai, Tamilnadu, INDIA

SEMESTER-I ***Core Theory***

CHE1521/CHS 1521 PHYSICAL CHEMISTRY-I ***5 hrs / 5 cr***

Course Objectives: The course covers the basic principles of physical chemistry that are the foundation for the beginners in chemistry. The course includes basic concepts of gaseous, liquids, liquid crystals, colloids and surface chemistry.

Course outcome:

At the end of the course, students will be able to

1. Deduce the gas laws, compute velocities of gas molecules, explain various properties of gases
2. Criticize the deviation of ideal gas behavior from real gas, deduce equations of state, explain the liquefaction of gases
3. Describe the properties of liquids, classify liquid crystals and discuss electric and magnetic properties of molecules
4. Classify colloids and illustrate its properties and application
5. State adsorption and its related terms, classify adsorption, deduce various adsorption isotherm and apply adsorption for various applications and ion exchange process

UNIT-I: Gaseous State-I 12 hours

The kinetic molecular theory of gases – derivation of the gas laws –the ideal gas equation – kinetic energy and temperature – Maxwell distribution of molecular speeds and energies – types of molecular speeds – expansivity and compressibility – collision parameters – mean free path – degrees of freedom of a molecule – principle of equipartition of energy

UNIT-II: Gaseous State-II 12 hours

Deviations from ideal behavior – equation of states for real gases – Vander Waals equation of state –other equations of state – intermolecular forces - the critical phenomena – P-V isotherm of carbon dioxide – the Vander Waals equation and critical states – Principle of corresponding states.- liquefaction of gases.

UNIT-III: Liquid State & Electric and Magnetic properties of molecules 12hours

Theory of liquids – vapour pressure – surface tension – surface active agents – viscosity – molar refraction - polarization – Clausius-Mosotti equation – Debye equation - Dipole moment - magnetic properties of molecules – Gouy's method - Liquid crystal – vapour pressure temperature diagrams – types of liquid crystals – arrangement of liquid crystals- Applications of liquid crystals.

UNIT-IV: Colloids 12hours

Colloidal systems – classification – preparation - a quick review – purification of colloids – properties – optical – charge on colloidal particles – electrical double layer – coagulation of colloids – electrophoresis – electro-osmosis – surfactants – protective colloids – gold number – emulsions – gels - introduction to micelles- applications of colloids.

UNIT-V: Surface Chemistry 12 hours

Adsorption – examples, adsorption versus absorption, mechanism of adsorption – types of adsorption – physisorption, chemisorption – characteristics – factors influencing adsorption- adsorption isotherms- Freundlich- Langmuir derivation – multilayer adsorption – B.E.T (derivation not necessary) – Gibbs adsorption isotherm-applications of adsorption – ion exchange adsorption – applications of ion exchange adsorption.

Textbook:

1. Puri. B.R., Sharma. L.R. and Pathania. M.S., Principles of Physical Chemistry, Vishal Publishing Co., 2014.

References:

1. P. L. Soni, O. P. Dharmarha, U. N. Dash, Textbook of Physical Chemistry, S. Chand & Sons., 2014.
2. B. S. Bahl, G. D. Tuli, ArunBahl, Essential of Physical Chemistry, S. Chand & Co.,2014.
3. G.W. Castellan, Physical Chemistry, 3rd edition, Addison-Wesley, 1983.

4. P.W. Atkins, Julio de Paula, Physical Chemistry, 8th edition, Oxford University Press, 2008.

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying	**X**	**X**			**X**
K4: Analyzing	**X**	**X**			**X**
K5: Evaluating	**X**	**X**			**X**
K6: Creating					

SEMESTER-I *CORE/ Theory*

CHE 1513/CHS 1513 INORGANIC CHEMISTRY-I *5 hrs / 5 cr*

Course Objectives:

The learners should be able to understand the periodic table, periodicity of properties, various metallurgical processes and s-block chemistry. This course also imparts knowledge about oxidation, reduction and acid base concepts and basic principles behind the volumetric analysis.

Course Outcome:

At the end of the course, the students will be able to:

1. identify and interpret the atomic properties of elements in the periodic table, and explain electronegativity
2. describe the various metallurgical processes and predict the feasibility of redox reactions
3. explain the acid - base concepts, classify and relate their strength and illustrate the reactions in different solvents
4. define forms of hydrogen, explain the properties of s-block elements and compounds
5. calculate the strength of solutions in different scales and explain the principles and types of titrimetry.

UNIT - I: PERIODIC TABLE AND ATOMIC PROPERTIES (12 Hrs)

Long form of periodic table – characteristics – classification of elements on the basis of electronic configuration – periodicity of properties – cause of periodicity – factors influencing– atomic radius – ionic radius – effective nuclear charge – Slater's rule– ionization energy, electron affinity, electronegativity – Pauling and Mulliken scales of electronegativity – applications of electronegativity – diagonal relationship – further extension of periodic table.

UNIT - II: METALLURGY (12 Hrs)

Occurrence of metals- steps involved in metallurgical processes- concentration of ore- calcination- roasting- reduction of free metal- electrometallurgy- hydrometallurgy- refining- thermodynamics of reduction processes- Ellingham diagram.

OXIDATION AND REDUCTION

Oxidation number- redox reactions- oxidizing agents- reducing agents - molecular and ionic equations- balancing of redox equations by ion electron method- auto oxidation- induced oxidation- standard electrode potential- electrochemical series- applications - Lattimer diagrams.

UNIT - III: ACID –BASE CONCEPT (12Hrs)

Arrhenius theory- Bronsted – Lowry concept- Lewis concept – solvent system concept- levelling solvents–Lux flood concept –Usanovich definition – factors influencing relative strengths of acids and bases- HSAB principle and its applications.

NON- AQUEOUS SOLVENTS

Physical properties of solvent- types of solvents and their general characteristics – protic solvent like H_2O – reaction in non-aqueous solvents with reference to liquid $NH_3$and liquid HF.

UNIT - IV: s- BLOCK CHEMISTRY (12 Hrs)

Hydrogen – isotopes –reactive forms of hydrogen – nascent hydrogen – active hydrogen –ortho and parahydrogen –isotopes of hydrogen- occluded hydrogen –uses-heavy water

Alkali metals and alkaline earth metals – General characteristics-electronegativity -ionisation energy – electropositive character – reducing properties – flame colour – hydration energy – lattice energy and solubility of salts –biological importance –anomalous behaviour of lithium and beryllium –Diagonal relationship of Li & Mg and Be & Al–Compounds of alkali metals – hydroxides– oxides –peroxides–superoxides– wrap around complexes–preparation properties and uses of NaOH, $NaHCO_3$, Plaster of Paris , basic beryllium acetate –Hardness of water

UNIT - V: ANALYTICAL CHEMISTRY-I (12 Hrs)

Titrimetric method of analysis – end point – equivalence point – requirements – types equivalent masses – electronic concept – concentration systems – molarity – normality – formality – weight percentage – ppm - primary standard – standardization – dilution – percentage purity – acid - base neutralisation titration – theory of acid-base indicators–mixed indicators – precipitation titration – indicator –redox titration–reagents used – structural chemistry of redox indicators –

iodometry–chelometric titrations –chelons –metallochromic indicators –EDTA titration methods –selectivity – masking of ions

Text book:

1. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, 2012 .

References:

1. J.D. Lee, Concise Inorganic Chemistry, Vedition., Chapman & Hall, 2000.
2. F.A Cotton and G. Wilkinson.,L.G. Paul., Basic Inorganic Chemistry III Edition John wileyEducation (Singapore) 2004.
3. P.L.Soni., Mohan Katyal, A text book of Inorganic Chemistry, Sultan Chand& Sons, 2006
4. Day Jr R.A. Underwood A.L, Quantitative analysis ,Prentice Hall of India, New Delhi, 2006.
5. R. Gopalan, P.S Subramanian, K Rengarajan ,Elements of Analytical Chemistry,Sultan Chand and sons, NewDelhi

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit 1	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying	**X**	**X**	**X**		**X**
K4: Analyzing					
K5: Evaluating					
K6: Creating					

SEMESTER-I *CORE Lab*

INORGANIC QUANTITATIVE ANALYSIS (VOLUMETRIC)
CHE 1331/CHS 1331

3 hrs / 3 cr

Course Objectives:

This is a laboratory course intended to understand the principles of quantitative analytical techniques and acquire the analytical skill of the students in the quantitative determinations of inorganic compounds by volumetric method.

Course Outcome:

At the end of the course, the students will be able to:

1. handle the apparatus effectively
2. prepare standard solutions and inorganic complexes
3. estimate the unknown quantity of the analyte by choosing standard methods
4. perform instrument handling, note book entry and calculations
5. propose methods to analyze quantitatively commercial and environmental samples.

I. ACIDIMETRY
- 1.Estimation of HCl– Link NaOH -standard oxalic acid
- 2. Estimation of Na_2CO_3 and $NaHCO_3$ mixture –Link HCl - standard Na_2CO_3

II. PERMANGANOMETRY
- 3. Estimation of oxalic acid
- 4.Estimation of FAS

III. DICHROMETRY
- 5. Internal indicator method
- 6. External indicator method

IV. IODOMETRY
- 7. Estimation of potassium dichromate

V. COMPLEXOMETRY
- 8.Estimation of Zn^{2+}
- 9. Hardness of water- temporary and permanent

VI. PREPARATION OF COMPLEXES
- 10. Tetraamminecopper(II) sulphate
- 11. Potassium trioxalatoferrate(III)

References:

1. V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic principles of practical Chemistry, 2nd Edt, Sultan Chand & sons publisher, 1997.
2. A. I. Vogel, "Quantitative Inorganic Analysis", ELBS, 3rd Edition, 1971
3. Lab Manual prepared by Department of chemistry

Mapping of Bloom's Taxonomy with Course Outcome					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding		**X**	**X**	**X**	**X**
K3: Applying		**X**	**X**		**X**
K4: Analyzing					**X**
K5: Evaluating					
K6: Creating					

SEMESTER-I *MAJOR SUPPORTIVE*(**Theory**)

CHS1371 CHEMISTRY FOR BIOCHEMIST – I ***3 hrs / 3 cr***

Course Objectives:

This course discuss about atomic structure, chemical bonding and energetics. It also deals the basics of organic chemistry, solution and nuclear chemistry.

Course Outcome:

At the end of the course, the students will be able to

1. Explain theories of chemical bonding.
2. Describe hybridization, nomenclature, types of organic reactions and reaction intermediates.
3. State and explain thermodynamic parameters.
4. Explain the mathematical expressions for pK_a, pK_b, K_{sp}, Henderson equation and describe osmosis.
5. Illustrate principles and applications of nuclear chemistry and radioactivity.

THEORY COMPONENT [3hrs / week]

UNIT - I: Atomic structure, Periodic properties and Chemical bonding (9 Hrs)

Shapes of s & p orbitals – electronic configuration for H to F – definitions of Ionization energy, Electron affinity & Electro negativity – Ionic bond – lattice energy – Born - Haber cycle - Covalent bond – VSEPR model – BCl_3, CH_4, NH_3, H_2O – MO theory – MO diagram for H_2, He_2, N_2, O_2, F_2 – Hydrogen bond – Consequences of hydrogen bonding

UNIT – II: Basics of Organic Chemistry (9 Hrs)

Tetravalent Carbon – Aliphatic and Aromatic compounds – Structure – A.O overlap concept – Hybridization – sp^3, sp^2, sp – Functional groups – Nomenclature – Types of organic reactions – substitution, addition, elimination, oxidation, reduction reactions – Reactive intermediates – carbocations, carbanions, free radicals – Generations and their stability

UNIT - III: Energetics (9 Hrs)

Spontaneous and Non spontaneous changes, Criterion for spontaneity, Entropy, Second law of thermodynamics, Measurement of Entropy, Free Energy and chemical equilibrium – law of mass action, Entropy Change in Phase Transformation, Le Chatelier principle – application of thermodynamics to biological systems

UNIT – IV: Solution Chemistry (9 Hrs)

Aqueous solution – Acid-Base equilibria – pKa & pH – Relative strength of acids and bases from K_a and K_b values – Buffer solutions – Preparation of acidic and basic buffers – Henderson equation – Solubility & Ksp – Types of solutions – Diffusion in solutions – osmosis and osmotic pressure – measurement of osmotic pressure – isotonic solutions, reverse osmosis – significance of osmosis in biological systems

UNIT - V: Nuclear Chemistry and Radioactivity (9 Hrs)

Types of radiations – nucleons – isotopes, isobars & isotones – mass defect – n/p ratio and nuclear stability – the group displacement law – rate of radioactive decay – half life period– nuclear fission and fusion, definition & comparison – artificial radioactivity – application of radio isotopes

References:

1. R. Gopalan, S. Sundaram, Fundamentals of Chemistry, Sultan Chand & Sons, 1988
2. R. Gopalan, S. Sundaram, Allied Chemistry, Sultan Chand & Sons, 1993
3. R. Gopalan, Inorganic Chemistry for Undergraduates, Universities Press, 2009
4. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, ShobanlalNaginChand& Co, 1995.
5. B. S. Bahl, ArunBahl, A Text Book of Organic Chemistry, S. Chand & Co., 1989
6. P. L. Soni, Textbook of Organic Chemistry, Sultan Chand & Sons, 1998
7. B. S. Bahl, ArunBahl, A Text Book of Physical Chemistry, S. Chand & Co., 1989
8. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Physical Chemistry, Shoban lal NaginChand& Co, 1998

Mapping of Bloom's Taxonomy with Course Outcome					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying					
K4: Analyzing					
K5: Evaluating					
K6: Creating					

SEMESTER-I *MAJOR SUPPORTIVE*(**Theory**)

CHE 1381 **CHEMISTRY FOR BOTANIST – I** ***3 hrs/3 cr***

Course Objectives:

This is an introductory course on understanding basic concepts in terms of chemistry. This course will attempt to make the students aware of fundamental chemistry of atomic structure, periodic properties and chemical bonding in inorganic complexes. Also to get the basic knowledge in organic chemistry, biomolecules and solution chemistry.

Course Outcome:

At the end of the course, the students will be able to

1. Write electronic configuration and illustrate periodic properties
2. Explain different forms of chemical forces in inorganic compounds
3. Write IUPAC nomenclature, illustrate types, hybridization, functional group and reactions in organic compounds
4. Define pKa, pK_b and pH and list the types of solutions
5. Classify amino acids, proteins, carbohydrates, explain their properties and applications

THEORY COMPONENT: **(3 hours / week)**

Unit–I Atomic Structure and Periodic properties (8 Hrs)

Atom-Atomic number–Build-up of elements-Hunds' rule–sequence of energy levels–Arrangement of elements in periodic table–Electronic configuration (upto Z=30)–Definition–atomic size, Ionization energy, electro affinity, electronegativity.

Unit–II Chemical bonding (8 Hrs)

Octet rule-Ionic bond-examples-properties-Covalent bond-Shapes of s, p and d orbitals-A.O overlap concept of σ and π bond–Coordinate bond–Weak interactions-vander Waal's, hydrophobic, London, dipole-dipole and ion-dipole–Hydrogen bond-types–importance–metallic bond–electron sea model.

Unit–III Basics of Organic Chemistry (8 Hrs)

Tetravalent Carbon-Aliphatic and Aromatic compounds-Hybridization–sp^3, sp^2, sp -Functional groups–nomenclature–Types of organic reactions–oxidation, reduction, substitution, addition, elimination–rearrangement.

Unit–IV Solution Chemistry (8 Hrs)

Aqueous solution-Acid-Base equilibria–pKa, pK_b and pH–Buffer solutions–Types of solutions–based on nature and amount of solute/solvent–Determination of concentration of solutions expressed in various scales–percentage, molarity, molality, normality and ppm.

Unit–V Chemistry of Biomolecules (8 Hrs)

Introduction, classification, synthesis, chemical properties and biological interests of amino acids–Structure and applications of protein–nucleic acids- Introduction and classification of carbohydrates- D/L configuration–Manufacture of Glucoseand Sucrose.

Text book:

1. J. Fisher and J. R. P. Arnold, Instant notes in Chemistry for biologists, Viva books Private Ltd., Series editor B. D. Hames bio Scientific Publishers Ltd., 2002.

References:

1. R. Gopalan, S. Sundaram, Fundamentals of Chemistry, Sultan Chand and Sons,1988.
2. R. Gopalan, S. Sundaram, Allied Chemistry, Sultan Chand and Sons, 1993.
3. R. Gopalan, Inorganic Chemistry for Undergraduates, Universities Press, 2009.
4. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, S. Chand and Co., 1995.
5. B. S. Bahl, ArunBahl, A textbook of Organic Chemistry, S. Chand and Co., 1989.
6. P. L. Soni, Textbook of Organic Chemistry, Sultan Chand and Sons, 1998.
7. B. S. Bahl, ArunBahl, A textbook of Physical Chemistry, S. Chand and Co., 1989.
8. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry , Vishal Publishing Co., 1998.

Mapping of Bloom's Taxonomy with Course Outcome					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**

K2: Understanding	**X**	**X**	**X**		**X**
K3: Applying					**X**
K4: Analyzing					
K5: Evaluating					
K6: Creating					

SEMESTER I **MAJOR SUPPORTIVE (Lab)**

CHE 1183 CHEMISTRY LAB FOR BOTANISTS–I 2 hrs / 1 cr

Course objectives:

Main objective of this program is to encourage more hands-on training to undergraduate students by adding more individualized practical exercises**.** Also this course is intended for students to quantitatively estimate metal ions like iron, manganese, calcium, zinc. This course is also supported by STAR college programme.

Course Outcome:

At the end of the course, the students should be able to

1. Identify and handle volumetric apparatus
2. Estimate acids, bases and metal ions (Fe, Zn) in given solution
3. Perform experiments to analyze commercial samples like pyrolusite and vinegar
4. Prepare metal nano particles by green method
5. Determine quality parameters in water, food samples and tablets

Experiments

1. Estimation of Sodium Carbonate
2. Estimation of acetic acid in vinegar
3. Estimation of Manganese dioxide in pyrolusite
4. Estimation of Fe(II)-Permanganometry
5. Estimation of Fe(II)-Dichrometry/External indicator
6. Estimation of Zn (II)-Complexometry
7. Spectrometric determination of the glucose level in jam
8. Preparation of silver nanoparticles by green synthesis method
9. Preparation of copper nanoparticles by green synthesis method
10. Disintegration and dissolution of drug molecules (tablets)
11. Analysis of pH , TDS, DO and Salinity of various water samples.
12. Determination of pH from various commercially available bevarages

References

1. V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic principles of practical Chemistry, 2nd Edt, Sultan Chand & sons publisher, 1997.
2. Lab Manual prepared by Department of chemistry

Mapping of Bloom's Taxonomy with Course Outcome					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding		**X**	**X**	**X**	**X**
K3-Applying		**X**	**X**	**X**	**X**
K4-Analyzing			**X**	**X**	**X**
K5-Evaluating					
K6-Creating					

SEMESTER I **MAJOR SUPPORTIVE (Lab)**

CHS 1173 CHEMISTRY LAB FOR BIO-CHEMISTRY-I 2 hrs/ 1cr

Course objectives:

Main objective of this program is to encourage more hands-on training to undergraduate students by adding more individualized practical exercises**.** Also this course is intended for students to quantitatively estimate metal ions like iron, manganese, calcium, zinc. This course is also supported by STAR college programme.

Course Outcome:

At the end of the course, the students should be able to

1. Identify and handle volumetric apparatus
2. Estimate acids, bases and metal ions (Fe, Zn) in given solution
3. Perform experiments to analyze commercial samples like pyrolusite and vinegar
4. Prepare metal nano particles by green method
5. Determine quality parameters in water, food samples and tablets

Experiments

1. Estimation of Sodium Carbonate
2. Estimation of acetic acid in vinegar
3. Estimation of Manganese dioxide in pyrolusite
4. Estimation of Fe(II)-Permanganometry
5. Estimation of Fe(II)-Dichrometry/External indicator
6. Estimation of Zn (II)-Complexometry
7. Spectrometric determination of the glucose level in jam
8. Preparation of silver nanoparticles by green synthesis method
9. Preparation of copper nanoparticles by green synthesis method
10. Disintegration and dissolution of drug molecules (tablets)
11. Analysis of pH , TDS, DO and Salinity of various water samples.
12. Determination of pH from various commercially available bevarages

References

1. V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic principles of practical Chemistry, 2nd Edt, Sultan Chand & sons publisher, 1997.
2. Lab Manual prepared by Department of chemistry

Mapping of Bloom's Taxonomy with Course Outcome					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding		**X**	**X**	**X**	**X**
K3-Applying		**X**	**X**	**X**	**X**
K4-Analyzing			**X**	**X**	**X**
K5-Evaluating					
K6-Creating					

SEMESTER-I *NME – 1*

CHE 1261 CHEMISTRY IN EVERYDAY LIFE *3 hrs / 2 cr*

Course objectives:

In this course an attempt will be made to establish in very simple terms the place of chemistry in modern civilized living. There will be discussions on water, water pollution and its treatment, fertilizers, insecticides, polymer and its applications, explosives and drugs.

Course Outcome:

At the end of the course, the students should be able to

1. Explain the physical properties and qualities of various water
2. Describe the role of agrochemicals
3. Explain the importance industrial materials
4. Classify explosives and discuss their role
5. Define drugs and their types

UNIT- I: Water (8Hrs)

Electrolysis of water – water cycle – air in water – DO – BOD – COD – water pollution – control of water pollution-water treatment- Reverse osmosis- deioniser – Hygroscopy and deliquescence – water in crystals – efflorescence – hard water- soft water – permanent and temporary hardness - removal of hardness – advantage and disadvantage – potable water – standards for drinking water.

UNIT- II: Fertilizers and Insecticides (8Hrs)

Classification of fertilizers- natural manures- artificial manures- chemical fertilizers-advantages of artificial fertilizers–bio-fertilizers – insecticides- inorganic insecticides- natural or plant insecticides-organic insecticides (few eg.) -dinitro phenols, DDT, methoxychlor, BHC-pesticides - disadvantages – bio-pesticide- bluegreen algae, vermicompost.

UNIT- III: Polymers and Modern materials (8Hrs)

Fibres: Natural and synthetic fibres- cotton, wool, coir, silk, linen, polyester, viscose rayon.
Synthetic polymer- organic polymer- inorganic polymer- silicon based polymer and its uses – conducting polymer – biodegradable polymers.
Resins: phenol- formaldehyde resins- resins on protective coatings- household appliances – PVC- HDPE-LDPE- Teflon- natural rubber – vulcanization- recycled plastics – polymers in medicinal toilet items.

UNIT-IV: Explosives (8Hrs)

Explosives- classification-deflagrating or low explosives-characteristics of explosives (few eg.)-nitrocellulose, PETN, TNT, RDX, cordite, gun powder-rocket fuels - propellants- toxic chemical weapons-screening smokes- pyrotechnics-safety matches.

UNIT-V: Drugs (8Hrs)

Definition- chemotherapy- antibiotics – analgesics – narcotic analgesics- NSAID – medicines from plants.

References:

1. R. Gopalan and S. Sundaram, Fundamentals of Chemistry, Sultan Chand & Sons,1998.
2. G. S. Sodhi, Fundamental Concepts of Environmental Chemistry, Narosa Publishing House,New Delhi,2002.
3. D.Ainley,J.N. Lazonby,A.J.Masson, Chemistry in Today's World.
4. B.N. Chakravarthy, Industrial Chemistry, Oxford and IBH Publishing Co, New Delhi.
5. G. Mahapatra, Elements of Industrial Chemistry, Kalyani Publishers, New Delhi.
6. AshutoshKar, Medicinal Chemistry, Wiley Eastern Ltd., 1992.
7. B.K. Sharma, Industrial Chemistry, Goel publishing & Co, 1995.

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding	**X**	**X**	**X**	**X**	
K3-Applying				**X**	

K4-Analyzing					
K5-Evaluating					
K6-Creating					

SEMESTER-I *NME – 1*

CHS 1251 **DAIRY CHEMISTRY** ***3 hrs / 2 cr***

Course objectives:

This course enriches the student's understanding about the milk and the various techniques involved during the processing and preservation of milk. This course also deals with various dairy products such as special milk, milk derivatives, and fermented milk products derived from milk.

Course Outcome:

At the end of the course, the students should be able to

1. Describe physical properties, composition, structure and constituents of milk
2. Discuss the microbiology of milk and various pasteurisation techniques
3. Explain composition, chemistry of milk derivatives and Identify the common adulterants in ghee
4. Define and construct the flow chart for manufacturing various kinds of special milks
5. Describe various milk products

Unit-I: Composition of milk **(8 Hrs)**

Composition and structure of milk- constituents of milk- lipids, proteins, carbohydrates, vitamins and minerals- Properties of milk-odour, density, viscosity, optical properties, acidity, freezing point-Recknagel's effect- estimation of fats and total solids in milk

Unit-II: Milk processing and preservation **(8 Hrs)**

Microbiology of milk- Destruction of microorganism in milk- pasteurisation –types of Pasteurisation- bottle, Batch and HTST- ultra high temperature pasteurisation- preservatives and neutraliser

Unit- III: Basic Milk Derivatives **(8 Hrs)**

Cream- composition- chemistry of creaming process

Butter- composition- desibutter- salted butter

Ghee- major constituents- common adulterants added to ghee and their detection- rancidity – definition- prevention- antioxidants

Unit- IV: Special Milk **(8 Hrs)**

Definition- merits- flow diagram for manufacturing- reconstituted milk- homogenised milk – flavoured milk- vitaminised milk- toned milk- imitation milk- condensed milk- definition, composition and nutritive value

Unit- V: Milk products **(8 Hrs)**

Fermented milk products- definition of culture- cultured cream- cultured butter milk-cheese- unripened cheese- ripened cheese-paneer-yohurt and mazzorola cheese

Ice cream- types- ingredients- manufacture- stabilizer- emulsifiers and their role

Milk powder-skimmed milk powder- whole milk powder- buttermilk powder- types of drying process

References:

1. Sukumar De, Outlines of Dairy Technology, Oxford University Press, New Delhi. (2001)
2. Lillian Hoagland Meyer, Food Chemistry, CBS Publishers, New Delhi. (2004)

Mapping of Bloom's Taxonomy with Course Outcome					
Bloom's Taxonomy	**Unit-I**	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding	**X**	**X**	**X**	**X**	**X**
K3-Applying					
K4-Analyzing					
K5-Evaluating					

K6-Creating					

SEMESTER-I *LS-1*

CHE 1271/CHS 1271 COSMETICS AND CONSUMER PRODUCTS *3 hrs / 2 cr*

Course objectives:

This course enriches the students understanding about composition, purpose of the cosmetics and consumer products. This course also deals with Hair care and colorants,Face and body cosmetics, Chalk and Crayons Toiletries Inks and shoe polish Candle, and cleansing agents.

Course Outcome:

At the end of the course, the students should be able to

1. List the constituents of hair and hair colorants
2. Explain various cleansing agents and formulation
3. Identify the ingredients in cleansing agents
4. Prepare candle, chalk and crayons
5. List out the ingredients of ink and shoe polish

Unit-I: Hair care and colorants (8Hrs)

Hair structure-permanent hair waving-cold waving-shampoos-different types and formulations-hair conditioners and setting lotions-hair straightening-curling.

Hair colorants- hair lighteners and bleaches-temporary colorants-semi and permanent colorants-vegetable dyes-oxidation dyes and modifiers.

Unit-II: Face and body cosmetics (8Hrs)

Face powder-talcum powder-medicated powder-bleachers-facials-cold creams- sunscreen lotions-SPF factor- formulation.

Deodorants-Antiperspirants-distinction between astringents and deodorants- formulation-lotions-perfumes-formulation

Lipsticks-classification and formulation

Unit-III: Toiletries and cleansing agents (8Hrs)

Bath soap- bath powders – bath oils – water softeners-tooth pastes-ingredients-their characteristic functions-mouth washes-shaving creams-after shave preparations

Detergents- classification-formulation-cleansing action-optical brightners-bleachers-phenoyls-black phenoyls, scented phenoyls.

Unit-IV: Candle, Chalk and Crayons (8Hrs)

Candles-variety of candles-raw materials – machinery- method of candle making- Chalk – dust free chalk-crayons-machines and method

Unit-V: Inks and shoe polish (8Hrs)

Inks – types-blue, red, black, green and rubber stamp ink-composition-preparation

Shoe polish-basic ingredients-preparation method

***Note :**

Preparation of Face Powder, Tooth Power, Candle, Phenoyl, Soap & Detergents, Chalk, inks, and shoe polish will be given in the Laboratory.

References:

1. J.V.Simons, Science and Beauty Business Vol-1, Macmilan Education Ltd, 1989
2. B.K. Sharma, Industrial Chemistry, Goel publishing & Co, 1995.
3. Latest Cottage Industries 20th Edition by Mohan Malhotra

Mapping of Bloom's Taxonomy with Course Outcome					
Bloom's Taxonomy	**Unit-I**	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
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K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding		**X**		**X**	

K3-Applying				**X**	
K4-Analyzing					
K5-Evaluating					
K6-Creating					

Curriculum

for

First Year B.Sc Chemistry (AIDED & SF) Programme

(For those who were admitted from the academic year 2015-2016 onwards)

SEMESTER II

Since 1881

Undergraduate Department of Chemistry

The American College

(An Autonomous Institution Affiliated to Madurai Kamaraj University)

Madurai, Tamilnadu, INDIA

SEMESTER-II *CORE/ Theory*

CHE 1522/CHS 1522 ORGANIC CHEMISTRY – I *5 hrs / 5 cr*

Course objectives:

This course is intended to concentrate on the IUPAC nomenclature, general concepts like resonance, inductive effect, reaction types & intermediates, basic introduction to stereochemistry of organic compounds, and the chemistry of alkanes, cycloalkanes, alkenes and alkynes.

Course Outcomes:

At the end of the course, students will be able to:

1. Give IUPAC nomenclature to organic compounds and determine the empirical and molecular formula.
2. Explain the fundamental concepts behind organic reactions, reaction intermediates and purification of organic compounds.
3. Illustrate and analyze the stereochemical and conformational aspects of organic compounds.
4. Discuss preparation, properties and reactions of alkanes and cycloalkanes.
5. Apply the Markownikoff's and Saytzeff's rule to identify the product formation and identify various ways for synthesizing alkenes, alkadienes and alkynes along with their reactions.

Unit I: IUPAC nomenclature of organic compounds (12 Hrs)

IUPAC Nomenclature- Rules for naming the organic compounds-alkanes-alkenes-alkynes-cyclic aliphatic hydrocarbons-alkyl halides-alcohols-ethers-aldehydes- ketones-carboxylic acids-acid derivatives-nitroalkanes-amines.

Common errors in writing IUPAC names.

Quantitative elemental analysis-estimation of carbon, hydrogen, nitrogen, halogen and oxygen-calculation of empirical formula and molecular formula.

Unit II: Fundamentals of organic chemistry (12 Hrs)

Resonance-hyperconjugation-tautomerism - inductive and field effects - hydrogen bonding.

Homolytic and heterolytic bond breaking-types of reagents - electrophile and nucleophiles -types of organic reactions - energy considerations.

Reactive intermediates - carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples) - Assigning formal charges on intermediates and other ionic species.

Purification methods - Chromatographic methods – paper, TLC, column – distillation - recrystallization techniques.

Unit III: Stereochemistry (12 Hrs)

Concept of Isomerism - types of isomerism.

Optical isomerism - elements of symmetry - molecular chirality - enantiomers - stereogenic centre - optical activity - properties of enantiomers - chiral and achiral molecules with two stereogenic centres – diastereomers - threo and erythro diastereomenrs - meso compounds - resolution of enantiomers – inversion – retention - racemisation - relative and absolute configuration - sequence rules - D/L, R/S systems of nomenclature.

Geometric isomerism-determination of configuration of geometric isomers - E&Z nomenclature - geometric isomerism in oximes and alicyclic compounds.

Conformational isomerism-conformational analysis of ethane and n-butane - Newmann projection - Sawhorse formulae-Fischer and flying wedge formula-conformations of cyclohexane - axial and equatorial bonds-conformation of mono and di substituted cyclohexane derivatives.

Differences between configuration and conformation.

Unit IV: Alkanes and cycloalkanes (12 Hrs)

IUPAC nomenclature of branched and unbranched alkanes - alkyl group - classification of carbon atoms in alkanes - Isomerism in alkanes – sources - methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids) - physical properties and chemical reactions of alkanes -Mechanism of free radical halogenation of alkanes - orientation – reactivity and selectivity.

Cycloalkanes – nomenclature - methods of formation - chemical reactions - Baeyer's strain theory and its limitations - Ring strain in small rings (cyclopropane and cyclobutane) -theory of strainless rings - cyclopropane ring - banana bonds.
Fractions obtained from petroleum - methods of cracking - octane number - cetane number- synthetic petrol - petrochemicals.

Unit V: Alkenes, Alkadienes and Alkynes (12 Hrs)

Nomenclature of alkenes - methods of formation - mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration - Saytzeff rule - Hofmann elimination - physical properties and relative stabilities of alkenes - Chemical reactions of alkenes - mechanism involved in hydrogenation - electrophilic and free radical additions - Markownikoff's rule - hydroboration – oxidation – oxymercuration – reduction – epoxidation – ozonolysis - hydration - hydroxylation and oxidation with $KMnO_4$ -polymerizations of alkenes -substitution at the allylic and vinylic position of alkenes -Industrial application of ethylene and propene.
Methods of formation - conformation and chemiscal reactions of cycloalkenes.
Nomenclature and classification of dienes-isolated-conjugated and cumulated dienes -structure of allenes and butadiene - methods of formation – polymerization - chemical reactions-1,2 &1,4 (Michael addition) additions - Diel's Alder addition.
Nomenclature – structure and bonding alkynes - methods of formation - chemical reactions of alkynes - acidity of alkynes - mechanism of electrophilic and nucleophilic addition reactions – hydroboration – oxidation - metal ammonia reductions – oxidation -polymerization.

Textbook:

1. Jain. M.K. and Sharma. S.C., Textbook of Organic Chemistry, Vishal publishing Co, 4th edition, 2014.

Reference:

1. Morrison and Boyd., Organic Chemistry, Pearson publication, 7th edition, 2003.
2. Mehta. B. and Mehta.M., Organic Chemistry, Prentice–Hall of India Private limited, 2007.
3. Soni. P.L. and Chawla. H.M.,Textbook of Organic Chemistry , Sultan Chand and Sons, 28th edition, 2007.
4. D. Nasipuri, Stereochemistry of Organic Compounds, Wiley Eastern Ltd, 1991.

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying	**X**		**X**		**X**
K4: Analyzing	**X**		**X**		
K5: Evaluating					
K6: Creating					

SEMESTER-II *CORE/Theory*

CHE 1514/CHS 1514 INORGANIC CHEMISTRY-II *5 hrs / 5 cr*

Course objectives:

This course enables the students to understand the hybridization and shapes of inorganic molecules, ionic compounds and Lattice energy. Also gain knowledge aboutchemical forces, noble gases and the compounds of Group III and Group IV

Course outcome:

At the end of the course the students will be able to

1. discuss and apply various bonding theories to molecules
2. apply radius ratio rule and Fajan's rule to ionic solids, construct Born – Haber cycle and describe imperfections in crystals
3. discuss chemical forces, Hydrogen bonding and noble gases
4. outline characteristics of group III elements and compare the properties of their compounds
5. explain characteristics of group IV elements and their compounds.

UNIT - I: COVALENT BONDING (12Hrs)

Lewis theory- Sidgwick theory – sigma and pi bonds – variable covalency –VB theory and its limitations – types of hybridization and shapes of inorganic molecules and ions – VSEPR theory – regular and irregular geometries – MO theory – LCAO method – homo and hetero nuclear diatomic molecules – bond characteristics.

UNIT - II: IONIC BONDING (12Hrs)

Types of ionic solids – radius ratio rule – limiting radius ratios for coordination numbers 3, 4 and 6 – applications – limitations – close packing – ionic compounds of type AX, AX_2 – layer structure – lattice energy and Born Haber cycle – Born-Lande equation – solvation energy and solubility of ionic solids – polarizing power and polarisabilities of ions – Fajan's rule – imperfections in crystals.

UNIT - III: CHEMICAL FORCES (12Hrs)

Types of chemical forces – ion-dipole forces – dipole-dipole interaction – ion-induced dipole interaction – dipole-induced dipole interaction – London dispersion forces – Hydrogen bonding – types and consequences –applications.

THE NOBLE GASES

Occurrence – discovery – isolation of noble gases from atmosphere – physio- chemical method – physical properties of helium – compounds of xenon – fluorides – oxides – oxo fluorides – structures and shapes – uses of noble gases – clathrates.

UNIT - IV: BORON GROUP CHEMISTRY (12Hrs)

General characteristics – periodicity in group properties – diagonal relationship between boron and silicon – occurrence and uses of elements – comparative study of hydrides, oxides, hydroxides, trihalides– preparation and structure of borides – preparation, properties and structure of diborane – higher boranes and Wades rule – boron nitride – borazine – preparation, properties and uses of H_3BO_3

UNIT - V: CARBON GROUP CHEMISTRY (12Hrs)

General characteristics–catenation– unique character of carbon– comparison of carbon and silicon – Allotropy of carbon- diamond-graphite-fullerenes- grapheme –carbides–halides– oxides– silicates– classification– zeolites– ultramarines– silicone– glass– preparation properties and uses of freons, carborundum and lead pigments.

Text book:

1. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, 2012 .

References:

1. J.D. Lee, Concise Inorganic Chemistry, Vedition., Chapman & Hall, 2000.

2. P.L. Soni., Mohan Katyal, A text book of Inorganic Chemistry, Sultan Chand & Sons, 2006.
3. W.U. Malik, G.D. Tuli and R.D. Madan, Selected topics in Inorganic Chemistry, S.Chand& Co. Ltd., 2004.
4. R. Gopalan, Inorganic Chemistry for Undergraduates, University Press (India) Pvt. Ltd., 2009
5. J.E.Huheey, Principles of Structure andReactivity,IVEdn., Collins College Publishers 1993.

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying	**X**	**X**		**X**	**X**
K4: Analyzing				**X**	
K5: Evaluating					
K6: Creating					

SEMESTER-II ***CORE/ Lab***

CHE 1332/CHS 1332 ORGANIC QUALITATIVE ANALYSIS ***3 hrs / 3 cr***

Course objectives:

The laboratory course is designed to train students to qualitatively analyze elements present, saturation or unsaturation, aromatic or aliphatic nature, functional group present in the organic compounds and preparing derivative for the respective functional group.

Course Outcome:

At the end of the course, students will be able to:

1. Apply the basic organic theoretical concepts for analyzing the unknown compounds.
2. Identify the elements and functional group present in the compounds.
3. Select an appropriate derivative and develop the skills to prepare it
4. Confirm the derivative by determining the physical properties

Analysis of an organic compound

I. Elements present
II. Saturated/ Unsaturated
III. Aliphatic / Aromatic
IV. Functional groups
    1. Carboxylic acids and phenols
    2. Aldehydes and ketones
    3. Esters
    4. Carbohydrates- sugar – reducing and non-reducing
    5. Amines
    6. Amides
    7. Anilides
    8. Nitro compounds
V. Preparations of derivatives for some of these functional groups –recrystallization– melting point determination.
    1. Condensation (Oxime preparation)
    2. Bromination
    3. Hydrolysis of esters and amides
    4. Diazotization for amines and nitro compounds

References

1. N.S. Gnanpragasam and G. Ramamurthy, Organic Chemistry Lab Manual, S. Viswanathan Pvt. Ltd.

Mapping of Bloom's Taxonomy with Course Outcome				
	CO1	**CO2**	**CO3**	**CO4**
K1: Remembering	**X**	**X**	**X**	**X**
K2: Understanding	**X**		**X**	**X**
K3: Applying	**X**		**X**	**X**
K4: Analyzing			**X**	**X**
K5: Evaluating			**X**	
K6: Creating			**X**	

SEMESTER-II *MAJOR SUPPORTIVE*(**Theory**)

CHS1372 CHEMISTRY FOR BIOCHEMIST – II ***3 hrs / 3 cr***

Course Objectives:

This course discusses chemical kinetics, catalysis, spectroscopic techniques and stereo chemistry. It also deals with coordination chemistry and basic concepts of volumetric analysis.

Course Outcome:

At the end of the course, the students will be able to

1. Explain reaction rate parameters, enthalpy, Hess's law and Bomb calorimeter.
2. Describe the theoretical aspects of volumetric analysis.
3. Apply the concepts of co-ordination chemistry to explain properties and applications of coordination complexes.
4. State and analyze the stereochemistry of organic compounds.
5. Illustrate the principles and applications of UV-Vis, IR, NMR and mass spectroscopy techniques.

UNIT - I: Chemical Kinetics and Thermochemistry (9 Hrs)

Rate, order & molecularity of a reaction – rate equations – First, second and zero order reactions – half life time of a reaction – effect of temperature on reaction rate – activation energy – Arrhenius equation – enzyme catalysis – Michaelis-Menten hypothesis and its applications

Internal energy changes in chemical reaction – enthalpy of reaction at constant volume and at constant pressure – definitions with an example for enthalpy of combustion, neutralization, dissociation, formation – Hess's law and its applications – Bomb Calorimeter

UNIT – II: Concepts of Volumetric Analysis (9 Hrs)

General principle – types of titrations – requirements for titrimetric analysis – definition & problems on concentration terms: molarity, formality, normality, wt%, ppm, milliequivalence and millimoles – primary and secondary standards, criteria for primary standards – endpoint and equivalence point - theory of indicators – phenolphthalein, diphenylamine, EBT

UNIT - III: Co-ordination Chemistry (9 Hrs)

Coordination compounds – shapes of d- orbitals – Werner's theory – coordination number – types of ligands – nomenclature – concept of EAN – Paulings theory – CFT – CFSE – crystal field splitting in Octahedral field – spectrochemical series – chelation – application of complexes in qualitative, volumetric and gravimetric analysis

UNIT - IV: Stereochemistry (9 Hrs)

Stereochemistry and stereoisomerism – tetrahedral carbon – optical activity – plane polarized light – polarimeter – specific rotation – chiral centers – enantiomers and optical activity – specification of R and S configurations – diastereomers – meso structures – racemic modification – resolution – Geometrical isomers – E/Z nomenclature

UNIT – V: Basic spectroscopic techniques (9Hrs)

UV spectroscopy techniques – Introduction, Principle and Applications to organic compounds & bioinorganic molecules viz., hemoglobin, cytochrome, chlorophyll

IR spectroscopy, NMR spectroscopy and Mass spectrometry techniques – Introduction, Principle and Applications to Organic compounds.

References:

1. R. Gopalan, S. Sundaram, Fundamentals of Chemistry, Sultan Chand & Sons, 1988
2. R. Gopalan, S. Sundaram, Allied Chemistry, Sultan Chand & Sons, 1993
3. R. Gopalan, Inorganic Chemistry for Undergraduates, Universities Press, 2009
4. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, ShobanlalNaginChand& Co, 1995.
5. B. S. Bahl, ArunBahl, A Text Book of Organic Chemistry, S. Chand & Co., 1989
6. P. L. Soni, Textbook of Organic Chemistry, Sultan Chand & Sons, 1998
7. B. S. Bahl, ArunBahl, A Text Book of Physical Chemistry, S. Chand & Co., 1989
8. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Physical Chemistry, ShobanlalNaginChand& Co, 1998

Mapping of Bloom's Taxonomy with Course Outcome					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**

K3: Applying			**X**		
K4: Analyzing					
K5: Evaluating					
K6: Creating					

SEMESTER-II *MAJOR SUPPORTIVE*(**Theory**)

CHE 1382 **CHEMISTRY FOR BOTANIST – II** ***3 hrs/3 cr***

Course Objectives:

This is an introductory course on understanding basic concepts in terms of chemistry. This course will attempt to make the students aware of fundamental chemistry in the basic knowledge in Atmosphere, water, soil, food and photo chemistry.

Course Outcome:

At the end of the course, the students will be able to

1. Describe various chemical and photochemical reaction in atmosphere and its effects
2. Illustrate water treatment, hardness and define hygroscopy, deliquescence and efflorescence in crystal
3. Classify soil and give examples of various soil pollutants
4. Explain physical and chemical properties of fat, oil, milk and milk products
5. State laws of photochemistry, illustrate various photo-physical and chemical processes

THEORY COMPONENT: **(3 hours / week)**

Unit–I Atmospheric Chemistry (8 Hrs)

Atmosphere structure-composition of atmosphere–particulates–types and formation–Chemical and photochemical reactions in atmosphere–Oxygen and ozone chemistry–Greenhouse effect and global warming–Acid rain–Photochemical smog.

Unit–II Water Chemistry (8 Hrs)

Water Pollution–Control of pollution–DO–OD–COD–BOD–Reverse Osmosis-Deioniser–Hard water–water in crystals–Hygroscopy and deliquescence–efflorescence–Soft water–permanent and temporary hardness–removal of hardness–potable water–standards of drinking water (WHO) –algal bloom.

Unit–III Soil Chemistry (8 Hrs)

Importance of soil-composition and types of soil–pH of soil–Acidity & alkalinity and their causes (6 causes)-Emphasis towards industrial waste-Radioactive pollutants- Agricultural pesticides-Soil pollution by soluble salts.

Unit–IV Food Chemistry (8 Hrs)

Physical and Chemical properties of natural fats and oils–scope of food and vegetables preservation–additives–flavours–synthetic and natural colorants–Principles and methods of preservation.

Milk-Types, composition, chemical analysis, adulteration and checks for purity–pasteurization–value added milk products (cheese, paneer and ghee).

Unit–V Photochemistry (8 Hrs)

Laws of photochemistry–quantum yield–Fluorescence–Phosphorescence–Chemiluminescence–Bioluminescence–Photosensitization and its application to biological systems–photosynthesis.

Text book:

1. Anil Kumar De, Environmental Chemistry, Wiley Eastern Ltd., Second Edition, (1992).
2. H. Kaur, Environmental Studies, PragatiPraksahan, First edition, (2005).

References:

1. R. Gopalan, S. Sundaram, Fundamentals of Chemistry, Sultan Chand and Sons, (1998).
2. G. S. Sodhi, Fundamental concepts of Environmental Chemistry, Narosa Publications House, New Delhi, (2002).
3. B. S. Bahl, ArunBahl, A textbook of Organic Chemistry, S. Chand and Co., (1989).
4. P. L. Soni, Textbook of Organic Chemistry, Sultan Chand and Sons, (1998).
5. B. K. Sharma, Industrial Chemistry, Goel Publishing and Co., (1995).
6. R. Chang, Chemistry, Tata McGraw Hill Publishing Ltd., (2005).

Mapping of Bloom's Taxonomy with Course Outcome					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**

K2-Understanding	**X**	**X**	**X**	**X**	**X**
K3-Applying			**X**		
K4-Analyzing					
K5-Evaluating					
K6-Creating					

SEMESTER II **MAJOR SUPPORTIVE(Lab)**

CHS 1174 CHEMISTRY LAB FOR BIO-CHEMISTRY-II 2 hrs/ 1cr

Course objectives:

Main objective of this program is to encourage more hands-on training to undergraduate students by adding more individualized practical exercises Also this course is intended for students to qualitatively analyze the simple salts containing the following cations and anions. This course is also supported by STAR college programme.

Course Outcome:

At the end of the course, the students should be able to

1. Identify interfering acid radicals
2. Eliminate interfering anion
3. Perform a systematic analysis and identify the cations
4. Determine quality parameters of environmental samples and food products
5. Perform extraction of natural products

Experiments

1. Analysis of Salt-I
2. Analysis of Salt-II
3. Analysis of Salt-III
4. Analysis of Salt-IV
   (Cations: Pb(II), Cu(II), Cd(II), Bi(III), Fe(II), Mn(II), Ni(II), Co(II), Zn(II), Mg(II) & NH^{4+} Interfering Anions: Oxalate, tartrate, borate, fluoride, and phosphate)
5. Analysis of Ozone& CO_2 in air sample
6. Estimation of available nitrogen in soil samples
7. Estimation of available phosphorus in soil samples
8. Estimation of Borax in soil samples
9. Extraction, isolation and characterization of natural products
10. Measurement of density of various commercial milk samples.
11. Determination of fat content in milk and milk products.
12. Separation of cream from whole milk using cream separator

Extension activity:

Industrial visits to milk industry/ polymer industry/ beverage industry/ sugarecane industry

References:

1. V.V.Ramanujam, Inorganic Semimicro qualitative analysis, National Publishing company, Madras, 1974
2. Lab Manual prepared by Department of chemistry

Mapping of Bloom's Taxonomy with Course Outcome					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding		**X**	**X**	**X**	**X**
K3-Applying		**X**	**X**	**X**	**X**
K4-Analyzing				**X**	
K5-Evaluating					
K6-Creating					

SEMESTER II **MAJOR SUPPORTIVE(Lab)**

CHE 1184 CHEMISTRY LAB FOR BOTANISTS–II 2 hrs/ 1 cr

Course objectives:

Main objective of this program is to encourage more hands-on training to undergraduate students by adding more individualized practical exercises Also this course is intended for students to qualitatively analyze the simple salts containing the following cations and anions. This course is also supported by STAR college programme.

Course Outcome:

At the end of the course, the students should be able to

1. Identify interfering acid radicals
2. Eliminate interfering anion
3. Perform a systematic analysis and identify the cations
4. Determine quality parameters of environmental samples and food products
5. Perform extraction of natural products

Experiments

1. Analysis of Salt-I
2. Analysis of Salt-II
3. Analysis of Salt-III
4. Analysis of Salt-IV
   (Cations: Pb(II), Cu(II), Cd(II), Bi(III), Fe(II), Mn(II), Ni(II), Co(II), Zn(II), Mg(II) & NH^{4+} Interfering Anions: Oxalate, tartrate, borate, fluoride, and phosphate)
5. Analysis of Ozone& CO_2 in air sample
6. Estimation of available nitrogen in soil samples
7. Estimation of available phosphorus in soil samples
8. Estimation of Borax in soil samples
9. Extraction, isolation and characterization of natural products
10. Measurement of density of various commercial milk samples.
11. Determination of fat content in milk and milk products.
12. Separation of cream from whole milk using cream separator

Extension activity:

Industrial visits to milk industry/ polymer industry/ beverage industry/ sugarecane industry

References:

1. V.V.Ramanujam, Inorganic Semimicro qualitative analysis, National Publishing company, Madras, 1974
2. Lab Manual prepared by Department of chemistry

Mapping of Bloom's Taxonomy with Course Outcome					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding		**X**	**X**	**X**	**X**
K3-Applying		**X**	**X**	**X**	**X**
K4-Analyzing				**X**	
K5-Evaluating					
K6-Creating					

SEMESTER- II *NME-2*

CHE 1262 **FOOD CHEMISTRY** ***3 hrs / 2 cr***

Course objectives:

This course enriches the students understanding and skills about composition, preservation process and various milk products. This course also deals with food colours, food additives, food flavour added in various food articles and different methods of preservation.

Course Outcome:

At the end of the course, the students should be able to

1. Explain the physical properties and factors affecting the composition of milk and also identify the adulterants, preservatives, neutralizer in milk
2. Discuss the types of pasteurization, major constituents and chemistry of various milk products
3. Describe the principles and methods of processing of fruits and vegetables
4. Classify natural & synthetic colours, food additives and food flavours
5. List the various preservation techniques and quality control

Unit I: Composition of milk **(8 hrs)**

Milk-definition - general composition of milk - constituents of milk - lipids, proteins, carbohydrates, vitamins and minerals - physical properties of milk - colour, odour, acidity, specificgravity, viscosity and conductivity - Reckneckel effect - factors affecting the composition of milk - adulterants, preservatives and neutralizer - examples and their detection - estimation of fat, acidity and total solids in milk.

Unit II: Processing and major milk products **(8 hrs)**

Microbiology of milk - destruction of microorganism in milk – physic - chemical changes taking place in milk due to processing - boiling, pasteurization - types of pasteurization -Bottle, batch and HTST (High Temperature Short Time) – Vaccum pasteurization - Ultra High Temperature pasteurization.

Cream – composition - Chemistry of creaming process – estimation of fat in cream.

Butter – composition - theory of churning – desibutter - salted butter - estimation of acidity and moisture content in butter.

Ghee - major constituents - common adulterants added to ghee and their detection – rancidity – definition – prevention - antioxidants and synergists- natural and synthetic.

Unit III: Principle and methods of preservation **(8 hrs)**

Principles and methods of preservation – Asepsis - preservation by high temperature – pasteurization – sterilization - Aseptic canning - preservation by - low temperature – chemicals , sulphur dioxide, sodium benzoate, sodium meta bisulphite – drying - filtration – carbonation – sugar – fermentation – salt – acids - oils and spices – antibiotics - Irradiation.

Canning and bottling of fruits and vegetables - principles and process of canning - different methods - canning of fruits - canning and bottling of vegetables – canning of curried vegetables - specific requirements for canning of fruits and tomatoes.

Unit IV: Food colorants, additives and flavours **(8 hrs)**

Natural colouring matters – chlorophylls – carotenoids – anthocyanins – flavanoids – anthocyanins – tannins - quinines and xanthones betalains

Synthetic colours – permitted colours-banned colours - FPO, FSSAC, Agmark.

Food additives and brominated vegetable oils - functions and uses of food additives - classification of food additives - B.V.O – substances prohibited in foods - additives to be used with caution

Food flavours - flavour compounds – flavanoids – terpenoids - sulfur compounds - other volatile components - types of flavour - developed flavour - processed flavour - added flavour.

Unit V: Food processing and quality control **(8 hrs)**

Fruits and vegetables drying /dehydration - techniques – advantages of dehydration over sun drying.

Freezing – of fruits and vegetables - methods of freezing - sharp freezing – Quick freezing - cryogenic freezing – dehydro – freezing - dehydro freezing- freeze drying.

Quality control in Food processing Industry - F.P.O specification – storage life - permissible limits of preservatives - food toxins.

References:

1. Robert Jenness and Patom.S., Principles of Dairy Chemistry, Wiley, New York.
2. Rangappa K.S and Acharya K.T., Indian Dairy Products.
3. Wond F.P., Fundamentals of Dairy Chemistry, Springer.
4. Lampert L.M., Modern Dairy Products, Chemical publishing company Inc., NewYork.
5. Warder, Principles of Dairy Processing, Wiley, New York.
6. Sukumar De, Outlines of Dairy technology.

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding	**X**	**X**	**X**	**X**	
K3-Applying				**X**	
K4-Analyzing					
K5-Evaluating					
K6-Creating					

SEMESTER- II *NME-2*

CHS 1252 **CHEMISTRY IN TODAY'S WORLD** ***3 hrs / 2 cr***

Course objectives:

In this course an attempt will be made to establish in very simple terms the place of chemistry in today's world. There will be discussions on water treatment, industrial materials, biological samples, agrochemicals and biological chemistry.

Course Outcome:

At the end of the course, the students should be able to

1. Describe the physical properties and qualities of water
2. Explain the types, constituents and applications industrial materials
3. Interpret medical report of urine and blood samples
4. Discuss the role of agrochemicals
5. List the importance of vitamins, minerals and metals in biology

UNIT-I: Chemistry of water **(8 Hrs)**

Water- sources- impurities in natural water- air in water – Physical properties of water –DO – BOD – COD – Hardness and its disadvantages – softening of water – Potable water – purification of water- distillation–deionisation– reverse osmosis

Unit-II: Industrial Chemistry **(8 Hrs)**

Paints, Varnishes, lacquers andadhesives- types - constituents- applications– Ceramics – glasses Inks- types–Printing inks- ingredients- additives- properties of inks– Basics of LED, LCD

Unit- III: Clinical Chemistry **(8 Hrs)**

Composition of blood- normal values- blood pH- blood sugar- blood pressure- blood groups- presence of glucose in blood and urine – Cholesterol in urine - diabetes – types- glucose tolerance test-anaemia – ECG – MRI scan

Unit-IV: Agricultural Chemistry **(8 Hrs)**

Fertilizer- classification – natural manures- organic manures- chemical fertilizers- biofertilizers- Effect of excess fertilization and manuring- agrochemicals- insecticide – herbicides- fungicides- rodenticide- nematicides

UNIT V: Biological Chemistry **(8 Hrs)**

Vitamins -fat and water soluble -physiological functions– biological importance of minerals and trace elements – haemoglobin- function and poisoning– chlorophyll – antioxidants – metals in medicine – metal toxicity.

References

1. R. Gopalan and S. Sundaram, Fundamentals of Chemistry, Sultan Chand & Sons,1998.
2. RamnaikSood, Medical laboratory techniques- Methods and interpretation- III edition, Jaypeebrothers medical publishers, 1995.
3. B.N. Chakravarthy, Industrial Chemistry, Oxford and IBH Publishing Co, New Delhi.
4. G. Mahapatra, Elements of Industrial Chemistry, Kalyani Publishers, New Delhi.
5. B.K. Sharma, Industrial Chemistry, Goel publishing & Co, 1995.

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding	**X**	**X**	**X**	**X**	
K3-Applying					
K4-Analyzing					
K5-Evaluating					
K6-Creating					

SEMESTER-II **LS-2**

CHE 1272/CHS 1272 CHEMISTRY IN CRIME INVESTIGATION 3 hrs / 2 cr

Course objectives:

This is a preliminary course on understanding chemistry in crime investigation. This course will also to make the students aware of fundamental chemistry in criminology, forensic science and ballistics. This course also deals with the knowledge about biological substances, poisons, firearms, documents, currency and cybercrime.

Course Outcome:

At the end of the course, the students will be able to

1. Illustrate the various codes of criminal penology
2. Describe the finger prints, tracks and traces
3. Explain the importance of biological samples and identify various poisons and its treatment
4. Classify and Examine the arsons, explosives and ballistics
5. Explain forged documents, signature, currency coins and cyber crime

Unit I: Criminology and Forensic science (8 hrs)

Criminology – definition - nature and scope - types of crimes penology - Indian penal code - Indian evidence act - Indian criminal procedure code.

Forensic science – definition - principles and uses in crime investigation.

Unit II: Finger prints & Tracks-Traces (8 hrs)

Finger prints – patterns – classification - uses of finger print in crime investigation - direct and latent prints - development by powders - other methods of development - transfer methods of finger prints.

Tracks – Traces - Foot prints - casting of foot prints - residue prints - walking pattern - tire marks - miscellaneous traces & tracks - glass fracture - tool marks – paints - fibres.

Units III: Biological substances and poisons (8 hrs)

Blood – semen – saliva – sweat – urine – hair – skin - DNA analysis.

Poisons - types and classification-diagonosis of poisoning in the living and in the dead - clinical symptom - post-mortem appearances - treatment in cases of poisoning - antidotes.

Unit IV: Arsons, explosives and Ballistics (8 hrs)

Natural fires and arson - nature of action of fire - drifts and air supply - burning characteristics.

Explosives – definition – classification - compostion and mechanism of explosion - bombs.

Ballistics – classification - internal, external and terminal ballistics - small arms -classification and characteristics - laboratory examination of barrel washing and detection of powder residues by chemical tests.

Unit V: Cyber crimes and documents (8 hrs)

Cyber crimes - crime through network

Documents - Chemistry of paper and ink - writing paper - carbon paper – chalk – adhesives - sealing waxes - different types of forged signatures - simulated and traced forgeries -inherent signs of forgery models - writing of forged models - writing deliberately modified - use of ultraviolet rays - comparison of type written letters - counterfeit of currency and coins

References:

1. Saferstein, R., Criminalities and introduction to Forensic Science, Prentice Hall of India.1978
2. James, T.H. , Forensic Science.1987

Mapping of Bloom's Taxonomy with Course Outcome					
Bloom's Taxonomy	**Unit-I CO1**	**Unit-II CO2**	**Unit-III CO3**	**Unit-IV CO4**	**Unit-V CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding	**X**	**X**	**X**	**X**	**X**
K3-Applying				**X**	
K4-Analyzing					
K5-Evaluating					
K6-Creating					

Curriculum

for

Second Year B.Sc Chemistry (AIDED & SF) Programme

(For those who were admitted from the academic year 2015-2016 onwards)

SEMESTER III

Since 1881

Undergraduate Department of Chemistry

The American College

(An Autonomous Institution Affiliated to Madurai Kamaraj University)

Madurai, Tamilnadu, INDIA

SEMESTER-III *CORE/ Theory*

CHE 2521/CHS 2521 **Organic Chemistry–II** *5 hr/5 cr*

Course objectives:

This course will enable the students to learn and understand the concepts of aromaticity and basic nature of arenes, polynuclear hydrocarbons and halogen containing compounds. They will be able to comprehend the reactivity and physical nature of functional groups like alcohols, ethers, thiols, thioethers, epoxides and phenols.

Course Outcome:

At the end of the course, students will be able to:

1. Identify the aromaticity in molecules and discuss methods for synthesizing arene compounds and associated aromatic substitution reactions.
2. Describe the preparation, properties and reactions of polynuclear hydrocarbons naphthalene, phenanthrene and anthracene.
3. Analyze the mechanisms for S_N1, S_N2, E_1, E_2 reactions and apply them for synthesizing and converting haloalkanes and haloarenes to synthetically useful organic compounds.
4. Classify alcohols and illustrate methods for preparing and reacting alcohols, ethers, thioethers and epoxides.
5. Ascertain various name reactions involved in phenolic compounds

UNIT I: Aromaticity and Arenes (12 Hrs)

Structure of benzene–Resonance model–MO picture–concept of aromaticity–Huckel's rule, non-aromatic, antiaromatic

Arenes–Nomenclature of benzene derivatives–General methods of preparation–physical properties–chemical properties–orientation effect of substitution on electrophilic aromatic substitution–activating group, deactivating group, orientation and o/p ratio, energy profile diagram–free radical substitution–addition reaction–oxidation reaction–Birch reduction.

Biphenyl–preparation and reactions.

UNIT II: Polynuclear hydrocarbons (12 Hrs)

Naphthalene–isomerism–orbital picture–synthesis–physical properties–chemical properties–electrophilic aromatic substitution–orientation of disubstitution–addition reaction–uses–naphthol and napthylamine.

Anthracene–nomenclature and isomerism–synthesis–physical properties–chemical properties–reduction, electrophilic substitution reaction, oxidation, electrophilic addition reaction–anthraquinone.

Phenanthrene–synthesis–structure–properties.

UNIT III: Haloalkanes and Haloarenes (12 Hrs)

Classification and nomenclature of alkyl halides–Physical properties–Preparation and reactions of alkyl halides–Nucleophilic aliphatic substitution–S_N1 and S_N2 mechanism and kinetics with energy profile–$E_1$and E_2 elimination–orientation–vinyl and allyl halide–preparation and property–Poly halogen compounds (chloroform, carbon tetrachloride, freons)–Preparation and reactions of aryl halides–nuclear and side chain reactions–Reactivity and orientation in aromatic substitution reactions–Benzyne mechanism–Relative reactivities of alkyl vs allyl, vinyl and aryl halides–Synthesis and uses of DDT, BHC

UNIT IV: Alcohols, Thiols, Ethers, Thioethers and Epoxide (12 Hrs)

Classification and Nomenclature–Monohydric alcohol–physical properties–synthesis of alcohols from alkenes via oxymercuration and demercuration, hydroboration, oxidation, reduction–Reactions of alcohols-distinction between 1º, 2º and 3º alcohols-hydrogen bonding–acidic nature of alcohols

Dihydric alcohol–physical properties-method of formation–chemical reaction–oxidative cleavage via lead tetraacetate and periodic acid–pinacol-pinacolone rearrangement.

Trihydric alcohol–method of formation–chemical reaction–glycerol, dynamite, cordite–Estimation of number of hydroxyl groups

Thiols–Preparation and chemical reactions of thiols–comparison with alcohols–mustard gas.

Ethers–Structure and nomenclature of ethers–physical properties–preparation– Williamson's synthesis–Alkoxymercuration and demercuration–chemical reactions–cleavage and auto oxidation–analysis of ether–Ziesel's method–crown ethers (brief introduction).
Thioethers–Preparation and chemical reactions.
Epoxides–synthesis–reactions–acid and base catalyzed ring opening of epoxides–orientation of cleavage of epoxide–reaction with Grignard and organolithium reagents.

UNIT V: Phenols (12 Hrs)

Classification and nomenclature of monohydric, dihydric and trihydric phenols–preparation of phenol–physical properties of phenol–acidic nature–comparison with alcohols–resonance stabilization of phenoxide ion–reactions of phenol as acid, reaction pertaining to -OH group and benzene ring of phenol–electrophilic aromatic substitution–Mechanism of Fries, Claisen rearrangement, Gattermann synthesis, Houben-Hoesch reaction, Lederer-Manasse reaction, Libermann Nitroso reaction, Kolbe reaction, Reimer-Tiemann reaction, phthalein reaction–Analysis of phenol.

Textbook:

1. Jain. M.K. and Sharma. S.C., Textbook of Organic Chemistry, Vishal publishing Co, 4th edition, 2014.

References:

1. Morrison and Boyd., Organic Chemistry, Pearson publication, 7th edition, 2003.
2. Mehta. B. and Mehta.M., Organic Chemistry, Prentice–Hall of India Private limited, 2007.
3. Soni. P.L. and Chawla. H.M.,Textbook of Organic Chemistry , Sultan Chand and Sons, 28th edition, 2007.

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying			**X**	**X**	**X**
K4: Analyzing			**X**		**X**
K5: Evaluating					
K6: Creating					

SEMESTER-III *CORE Theory*

CHE 2513/CHS 2513 INORGANIC CHEMISTRY-III *5 hrs/5 cr*

Course objectives:

This is a course intended to impart knowledge about the solid state, metallic bond and chemistry of nitrogen, chalcogen and halogen groups. This course also deals with the theory behind the laboratory course and aims at enriching student's analytical learning and skill

Course outcome:

At the end of the course, the students will be able to:

1. explain concepts and laws of crystallography and bonding in metals
2. discuss the chemistry of the Group V elements & compounds and relate the structures of their hydrides and oxoacids
3. write the synthesis, discuss the bonding, properties and list the applications of group VI compounds
4. rationalize similarities and differences in properties among the elements & compounds of group VII
5. analyze data statistically, discuss the sources of errors and principles of gravimetry.

UNIT I: Solid state (12 Hrs)

Crystalline and amorphous solids–characteristics of solid – symmetry in crystals– laws of crystallography– unit cell-space lattice- basic crystal systems–Bravais lattices–number of atoms per unit cell–interplanar spacing in a crystal system–Miller indices– X ray diffraction– Bragg equation, experimental methods

Metallic Bond- Free electron and band theory-electrical properties of solids- super conductivity (elementary ideas only)

UNIT II: Group V (12 Hrs)

General characteristics– unique features of nitrogen– a comparative study of hydrides-preparations, properties and uses of N_2H_4, NH_2OH, HN_3 – oxo acids of nitrogen –nitric acid-oxidising properties – structures of oxides and oxoacids of phosphorus and nitrogen –halides of phosphorus – phosphazines.

UNIT III: Group VI (12 Hrs)

Gradient in properties–oxidation state–differences between oxygen and other elements–chemistry of ozone and H_2O_2– oxides of sulphur–thionyl and sulphuryl chlorides-oxoacids of sulphur- sulphuric, permono, perdisulphuric acid–SF_6, SCl_2, S_2Cl_2- preparation, properties and structures.

UNIT IV: Group VII (12 Hrs)

General characteristics- bond energies in X_2 molecules – oxidising power – reaction with water–reactivity of elements–peculiarities of fluorine–hydrogen halides–properties–energy cycle showing their acid strength – oxides of halogens –structures – oxyacids of chlorine– strength of oxyacids of halogens – interhalogen compounds–poly halides–basic properties of halogens–pseudohalogens and pseudohalides.

UNIT V: Analytical Chemistry-II (12 Hrs)

Gravimetric method of analysis: principle–mechanism and desirable properties of precipitates–common ion effect– solubility and ionic product–gravimetric factor–particle size, purity of precipitate–types of precipitate– surface adsorption–occlusion–coprecipitation–post precipitation– precipitation from homogeneous solution – digestion–filtration–washing– drying and incineration–organic and inorganic precipitants–applications.

Evaluation of analytical data-

Significant figures–types of error–sources and minimisation of errors–precision and accuracy–methods of expression –confidence limits – rejection of a result- Q test.

Textbook:

1. Puri. B.R., Sharma. L.R. and Kalia. K.C., Principles of Inorganic Chemistry, Milestone Publishers, 2012.

References:

1. Lee. J.D., Concise Inorganic Chemistry, Chapman & Hall, 5th edition, 2000.
2. Soni. P.L., Mohan Katyal, A Textbook of Inorganic Chemistry, Sultan Chand& Sons, 12th edition, 2006.
3. Day. R.A. Jr, Underwood. A.L., Quantitative analysis ,Prentice Hall of India, New Delhi, 6th edition, 2006.
4. Mendham. J., Denney. R.C., Barnes. J. D., Thomas. M.J.K., Vogel's Textbook of Quantitative Chemical Analysis, Pearson Edu. Ltd, *Singapore, 6th edition*, 2000.

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying	**X**	**X**	**X**	**X**	**X**
K4: Analyzing				**X**	**X**
K5: Evaluating					
K6: Creating					

SEMESTER-III *CORE/ THEORY*

CHE 2515/CHS 2515 PHYSICAL CHEMISTRY–II *5 hr/5 cr*

Course Objective: This course deals with the concepts and applications of thermodynamics. Properties of non-electrolytes along with colligative properties will be discussed.

Course outcome:

At the end of the course, students will be able to

1. Illustrate various terminologies and concepts related to first law of thermodynamics and thermochemistry
2. Explain thermodynamics based on second law of thermodynamics.
3. State third law and solve problems related third law of thermodynamics.
4. Compare various types of solutions of non-electrolytes.
5. Apply colligative properties and Nernst distribution law to explain various systems.

UNIT I: First law of Thermodynamics and Thermochemistry (12 Hrs)

Terminologies–thermodynamic equilibria–extensive and intensive properties–heat and work–first law–internal energy–state functions–cyclic rules–reciprocal relation–enthalpy–heat capacity–Cp and Cv–expansion of an ideal gas–isothermal expansion–adiabatic expansion–reversible and irreversible expansion–Joule Thomson effect–μ_{JT}–ideal gas coefficient–real gas coefficient–Zeroeth law of thermodynamics–absolute temperature scale.

Change of internal energy in a reaction–heat of reaction–q_p and q_v–standard enthalpy change–Kirchoff's equation–flame and explosion temperature–Hess's law and its applications–Bomb calorimeter–bond energies.

UNIT II: Second law of Thermodynamics (12 Hrs)

Limitations of I law–spontaneous process–cyclic process–Carnot cycle–entropy–second law of thermodynamics–entropy change in isothermal expansion of an ideal gas–entropy change in reversible and irreversible processes–phase change–calculation of entropy changes of an ideal gas with change in P,V and T–entropy of mixing–standard entropy–physical significance of entropy–work and free energy functions–variation of T and P–Maxwell's relationship–criteria for reversible and irreversible process, Gibbs-Helmholtz equation, Open system–partial molar properties, Gibbs–Duhem equation, Clapeyron–Clausius equation, Fugacity and activity–activity coefficient, standard states.

UNIT III: Third law of Thermodynamics and Chemical equilibrium (12 Hrs)

Nernst heat theorem–third law of thermodynamics–determination of absolute entropy–experimental verification of III law–entropies of real gases–entropy change in a chemical reaction–Boltzmann equation–residual entropy.

Spontaneous reactions–standard free energy changes–Chemical equilibrium–law of mass action–van't Hoff reaction isotherm–Kp and Kc–Homogeneous equilibria–temperature dependence–van't Hoff equation–Heterogeneous equilibria–Le Chatelier principle.

UNIT IV: Solutions of Non-Electrolytes (12 Hrs)

Solutions of liquids in liquids–Raoult's law–vapour pressure of ideal solution–temperature-dependence of vapour pressure of a solution–volume change of mixing for an ideal solution–entropy change of mixing–vapour pressure of real (non-ideal) solution–binary solutions–fractional distillation–Azeotropic mixture–Lever rule and fractional distillation–immiscible liquids–steam distillation–partially miscible liquids–critical solution temperature–phenol-water system–aniline-hexane system–Nicotine-water system–Solutions of gases in liquids–factors influencing solubility of a gas–Henry's law.

UNIT V: Colligative property and Nernst Distribution law (12 Hrs)

Colligative properties–vapour pressure lowering–osmotic pressure–theories of semi permeability–elevation of boiling point–depression of freezing point–abnormal results and van't Hoff factor. Nernst distribution law–application of Nernst distribution law–solvent extraction.

Textbook:

1. Puri. B.R., Sharma. L.R. and Pathania. M.S., Principles of Physical Chemistry, Vishal Pubishing Co., 2014.

References:

1. Castellan. G.W., Physical Chemistry, Addison-Wesley, 3rd edition, 1983.

2. Atkins. P.W. and De Paula. J., Physical Chemistry, Oxford University press, 8th edition, 2008.
3. Glasstone. S., A Textbook of Physical Chemistry, Macmillan(India) Ltd, 1976.
4. McQuarrie. D.A., Simon. J.D., Physical Chemistry, University Science Books, 1996.

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying			**X**	**X**	**X**
K4: Analyzing				**X**	
K5: Evaluating				**X**	
K6: Creating					

SEMESTER-III *CORELab*

CHE 2431/CHS 2431 INORGANIC QUALITATIVE ANALYSIS *4 hrs/4 cr*

Course Objective:

This is a laboratory course designed to improve the analytical skill of the students in the identification of the cations and anions in the mixture of inorganic salts.

Course Outcome:

At the end of the course, the students will acquire skill to:

1. analyse the interfering and non-interfering anions
2. eliminate the interfering anions
3. perform a systematic qualitative analysis
4. diagnose the cations
5. analyse cations and anions in food samples and environmental samples.

A mixture of inorganic salts which contains two cations and two anions will be given. Among them, one of the anion must be an interfering ion.

References

1. V.V. Ramanujam, Inorganic Semimicro qualitative analysis, National Publishing company, Madras, 1974

Mapping of Bloom's Taxonomy with Course outcome					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying	**X**		**X**	**X**	**X**
K4: Analyzing	**X**			**X**	**X**
K5: Evaluating					
K6: Creating					

SEMESTER-III ***MAJOR SUPPORTIVE*****(Theory)**

CHE2381/CHS 2381 CHEMISTRY FOR PHYSICISTS – I ***3 hr/3 cr***

Course Objective:

This course explains atomic structure, properties, chemical bonding, elementary aspects of organic chemistry, basics of energetic, chemistry of solutions and fundamentals of titrimetry and chromatography.

Course Outcome:

At the end of the course, the students will be able to

1. Explain periodic properties and describe theories of chemical bonding
2. Classify the organic compounds, reactions, intermediates and H-bonding
3. State and explain the applications of thermodynamic parameters
4. Explain the mathematical expressions for pK_a, pK_b, K_{sp} and describe osmosis
5. Explain titrimetric and chromatographic techniques

THEORY COMPONENT (3hrs / week)

UNIT I: Atomic structure, Periodic properties and Chemical bonding (8 Hrs)

Shapes of s, p and d orbitals, Electronic configuration up to 30 elements–Periodic properties–atomic size, Ionization energy, Electron affinity and Electro negativity–Ionic bond–lattice energy–Born-Haber cycle–Covalent bond–VSEPR model–BCl_3, CH_4, NH_3, H_2O–A.O overlap concept–Hybridization–sp^3, sp^2, sp–MO theory–MO diagram for H_2, He_2, N_2, O_2, F_2 .

UNIT II: Basics of Organic Chemistry (8 Hrs)

Tetravalent Carbon–Aliphatic and Aromatic compounds–Structure–Functional groups–Nomenclature–Types of organic reactions–substitution, addition, elimination, oxidation, reduction, rearrangement reactions–Reactive intermediates–carbocations, carbanions, free radicals–Generations and their stability–Hydrogen bond–types–consequences of hydrogen bonding.

UNIT III: Energetics (8 Hrs)

Spontaneous and Non spontaneous changes–Criterion for spontaneity–Entropy–Second law of thermodynamics–Measurement of Entropy–Free Energy and chemical equilibrium–law of mass action–Entropy Change in Phase Transformation–Le-Chatelier principle–application of thermodynamics to biological systems.

UNIT IV: Solution Chemistry (8 Hrs)

Aqueous solution–Acid-Base equilibria–pKa, pK_b and pH–Buffer solutions– Henderson equation–Solubility and Ksp–Types of solutions based on nature and amount of solvent/solute–determination of concentration of solutions expressed in various scales–percentage–molarity–molality and normality–Diffusion in solutions–osmosis and osmotic pressure–measurement of osmotic pressure–isotonic solutions–reverse osmosis–significance of osmosis in biological systems.

UNIT V: Analytical Chemistry (8 Hrs)

Titrimetry–Basic requirement for a titration–Acid-Base titrations–theory of acid-base indicators–redox titrations–complex metric titrations involving EDTA–metallochromic indicators.

Chromatography–Introduction–classification of chromatographic techniques–Paper Chromatography–Thin layer Chromatography–Column Chromatography–Principle and Applications

References:

1. Chang. R., Chemistry, Tata-McGraw Hill, 1st Indian Edition, 2007.
2. Gopalan. R., and Sundaram. S., Fundamentals of Chemistry, Sultan Chand and Sons, 1988
3. Puri. B. R., Sharma. L. R. and Kalia. K. C., Principles of Inorganic Chemistry, ShobanlalNaginChand and Co, 1995.
4. Gopalan. R., and Sundaram. S., Allied Chemistry, Sultan Chand and Sons, 1993.
5. Puri. B. R., Sharma. L. R. and Kalia. K. C., Principles of Physical Chemistry, Vishal Publications, 1998.
6. Soni. P. L., Textbook of Organic Chemistry, Sultan Chand & Sons, 1998.

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding	**X**	**X**	**X**	**X**	**X**
K3-Applying		**X**			
K4-Analyzing					
K5-Evaluating					
K6-Creating					

SEMESTER-III *MAJOR SUPPORTIVE*(**Theory**)

CHE 2383 CHEMISTRY FOR ZOOLOGISTS – I ***3 hr/3 cr***

Course Objective:

This course deals with atomic structure, chemical bonding, thermodynamics and solutions. It also deals the stereochemistry of organic compounds and photo chemistry.

Course Outcome:

At the end of the course, the students will be able to

1. Explain periodic properties and describe theories of chemical bonding
2. Write the nomenclature, State and analyze the stereochemistry of organic compounds
3. State laws of photochemistry, illustrate various photo-physical and chemical processes
4. State and explain the applications of thermodynamic parameters
5. Explain the mathematical expressions for pK_a, pK_b, K_{sp}, and describe osmosis

THEORY COMPONENT [3hrs / week]

UNIT–I Atomic structure, Periodic properties and Chemical bonding (8 Hrs)

Shapes of s, p and d orbitals, Electronic configuration for elements up to atomic number 30– Periodic properties–atomic size, Ionization energy, Electron affinity and Electro negativity–Ionic bond –Covalent bond–Coordinate covalent bond- Weak interactions –vander Waals, hydrophobic, London, dipole- dipole, ion- dipole and hydrogen bond- Metallic bond–electron sea model.

UNIT–II Nomenclature and Stereochemistry of Organic Compounds (8 Hrs)

Classification of organic compounds–Nomenclature of hydrocarbons–Substituted hydrocarbons–Functional groups and their priority–Isomerism–Geometrical and optical–Chirality–Enantiomers and Diasteroisomers– Absolute and Relative configuration–D/L, d/l, R/S, E/ Z notations–examples–racemic mixture–Mesocompound.

UNIT–III Photochemistry (8 Hrs)

Comparison between thermal and photochemical reactions, Laws of photochemistry–Quantum yield–Fluorescence–Phosphorescence–Chemiluminescence–Bioluminescence, Common photochemical reactions–Photosensitization and its application to biological systems–Photosynthesis.

UNIT–IV Thermodynamics (8 Hrs)

First, Second, Third laws of thermodynamics–Spontaneous and Non spontaneous changes, Criterion for spontaneity, Entropy–Entropy Change in phase transformation–Free Energy and chemical equilibrium–Le-Chatelier principle–Application of thermodynamics to biological systems.

UNIT–V Solution Chemistry (8 Hrs)

Aqueous solution–Acid-Base equilibria–pKa, pK_b and pH–Buffer solutions, Henderson equation–Solubility and Ksp–Types of solutions based on nature and amount of solute/solvent–determination of concentration of solutions expressed in various scales–percentage, molarity, molality and normality–Diffusion in solutions–osmosis and osmotic pressure– isotonic solutions, reverse osmosis–significance of osmosis in biological systems.

Textook:

1. Fisher. J. and Arnold. J.R.P., Instant notes in chemistry for biologists, Viva Books Private Ltd., Series editor B.D.Hames- Bio Scientific Publishers Ltd., 2002.

References:

1. Gopalan. R., Inorganic Chemistry for Undergraduates, Universities Press, 2009.
2. Jain. M.K. and Sharma. S.C., Modern Organic Chemistry–Vishal publishers, 2014.

Chang. R., Chemistry, Tata Mcgraw Hill Publishing Ltd, 2005.

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding	**X**		**X**	**X**	**X**
K3-Applying					

K4-Analyzing					
K5-Evaluating					
K6-Creating					

SEMESTER III **MAJOR SUPPORTIVE (Lab)**

CHE 2181 /CHS 2181 CHEMISTRY LAB FOR PHYSICISTS–I 2 hrs / 1cr

Course objectives:

Main objective of this program is to encourage more hands-on training to undergraduate students by adding more individualized practical exercises**.** Also this course is intended for students to quantitatively estimate metal ions like iron, manganese, calcium, zinc. This course is also supported by STAR college programme.

Course Outcome:

At the end of the course, the students should be able to

1. Identify and handle volumetric apparatus
2. Estimate acids, bases and metal ions (Fe, Zn) in given solution
3. Perform experiments to analyze commercial samples like pyrolusite and vinegar
4. Prepare metal nano particles by green method
5. Determine quality parameters in water, food samples and tablets

Experiments

1. Estimation of Sodium Carbonate

2. Estimation of acetic acid in vinegar

3. Estimation of Manganese dioxide in pyrolusite

4. Estimation of Fe(II)-Permanganometry

5. Estimation of Fe(II)-Dichrometry/External indicator

6. Estimation of Zn (II)-Complexometry

7.Spectrometric determination of the glucose level in jam

8. Preparation of silver nanoparticles by green synthesis method

9. Preparation of copper nanoparticles by green synthesis method

10. Disintegration and dissolution of drug molecules (tablets)

11. Analysis of pH , TDS, DO and Salinity of various water samples.

12. Determination of pH from various commercially available bevarages

References

1. V. Venkateswaran, R. Veerasamy, A. R. Kulandaivelu, Basic principles of practical Chemistry, 2nd Edt, Sultan Chand & sons publisher, 1997.
2. Lab Manual prepared by Department of chemistry

Mapping of Bloom's Taxonomy with Course Outcome					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding		**X**	**X**	**X**	**X**
K3-Applying		**X**	**X**	**X**	**X**
K4-Analyzing			**X**	**X**	**X**
K5-Evaluating					
K6-Creating					

SEMESTER III **MAJOR SUPPORTIVE (Lab)**

CHE 2183 CHEMISTRY LAB FOR ZOOLOGIST–I 2 hrs / 1 cr

Course objectives:

Main objective of this program is to encourage more hands-on training to undergraduate students by adding more individualized practical exercises**.** Also this course is intended for students to quantitatively estimate metal ions like iron, manganese, calcium, zinc. This course is also supported by STAR college programme.

Course Outcome:

At the end of the course, the students should be able to

1. Identify and handle volumetric apparatus
2. Estimate acids, bases and metal ions (Fe, Zn) in given solution
3. Perform experiments to analyze commercial samples like pyrolusite and vinegar
4. Prepare metal nano particles by green method
5. Determine quality parameters in water, food samples and tablets

Experiments

1. Estimation of Sodium Carbonate

2. Estimation of acetic acid in vinegar

3. Estimation of Manganese dioxide in pyrolusite

4. Estimation of Fe(II)-Permanganometry

5. Estimation of Fe(II)-Dichrometry/External indicator

6. Estimation of Zn (II)-Complexometry

7.Spectrometric determination of the glucose level in jam

8. Preparation of silver nanoparticles by green synthesis method

9. Preparation of copper nanoparticles by green synthesis method

10. Disintegration and dissolution of drug molecules (tablets)

11. Analysis of pH , TDS, DO and Salinity of various water samples.

12. Determination of pH from various commercially available bevarages

References

1. V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic principles of practical Chemistry, 2nd Edt, Sultan Chand & sons publisher, 1997.
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K2-Understanding		**X**	**X**	**X**	**X**
K3-Applying		**X**	**X**	**X**	**X**
K4-Analyzing			**X**	**X**	**X**
K5-Evaluating					
K6-Creating					

Curriculum

for

Second Year B.Sc Chemistry (AIDED & SF) Programme

(For those who were admitted from the academic year 2015-2016 onwards)

SEMESTER IV

Since 1881

Undergraduate Department of Chemistry

The American College

(An Autonomous Institution Affiliated to Madurai Kamaraj University)

Madurai, Tamilnadu, INDIA

SEMESTER-IV ***CORE/ Theory***

CHE 2522/CHS 2522 **Organic Chemistry–III** ***5 hrs/5 cr***

Course objectives:

This course is aimed at giving ample information on structure, reactivity, and properties of aldehydes, ketones, carboxylic acids, amines, nitro compounds and heterocyclic compounds. After the completion of this course, the students will be able to appreciate the mechanism and reactivity of these functional groups.

Course Outcome:

At the end of the course, students will be able to:

1. Analyze the methods of preparing aldehydes and ketones and various condensation, oxidation and reductions reactions pertaining to them.
2. Examine the preparation, properties and reactions of carboxylic acids and its derivatives.
3. Predict the methods for preparing amines and diazonium compounds and suggest methods for converting them to synthetically useful organic precursors.
4. Illustrate preparation and reactions of nitro, nitrile and isonitrile compounds.
5. Analyze the basic nature of heterocylic compounds and identify methods for preparing them along with their chemical properties.

UNIT I: Aldehydes and Ketones **(12 Hrs)**

Structure and nomenclature (aliphatic and aromatic)–synthesis–aldehydes and ketones–with particular reference to the synthesis from acid chloride, nitriles, ozone, Grignard reagent, alkyne, carboxylic acids–relative reactivities of aldehyde and ketone–Reactions-mechanism of nucleophilic addition to carbonyl group with particular emphasis on condensation reactions–Benzoin, Aldol, Crossed Aldol (with special reference to acraldehyde, crotonaldehyde, cinnamaldehyde), Perkin, Claisen-Schmidt, Knoevenagel reaction–condensation with ammonia and its derivatives, nitriles, nitroalkanes, alcohols–Wittig and Mannich reaction.

Oxidation of aldehyde–Baeyer-Villiger oxidation of ketones, Cannizaro reaction–Reduction–Meerwein-Pondoroff-Verely, Clemmensens, Wolff-Kishner, $LiAlH_4$, $NaBH_4$–Halogenation of enolizable ketones–Haloform reactions–introduction to α,β-unsaturated aldehyde and ketones–Distinction between aldehyde/ketone andaliphatic/aromatic aldehyde ***(mechanism not required for all the reactions***)

UNIT II: Carboxylic acids and derivatives **(12 Hrs)**

Structure, bonding and nomenclature (aliphatic and aromatic)-physical properties–acid strength and effect of substitution on acid strength-preparation and reactions of carboxylic acids–Hell-Volhard-Zelinsky reaction–reduction and decarboxylaton-nucleophilic substitution at acyl carbon.

Preparation and chemical reactions of hydroxy acids–malic acid, tartaric acid, citric acid.

Acid derivatives-structure and nomenclature of acid chloride, ester, amides, acid anhydrides–relative strength of acyl derivatives-physical properties–Interconversion of acid derivatives by nucleophilic acyl substituition-preparation and chemical reactions of acid derivatives–Mechanism of esterification and hydrolysis(acid and base catalyzed).

UNIT III: Amines and diazonium compounds **(12 Hrs)**

Structure and nomenclature of amines–physical properties-separation of 1^o, 2^o and 3^o amines–basicity of amines–preparation of alkyl and aryl amines-reduction of nitro, nitrile, reductive amination of aldehyde and ketonic compounds, Hofmann, Curtius, Lossen, Schmidt, Wolff rearrangement, Gabriel phthalimide reaction, Hofmann-bromamide reaction–Reactions of amines–alkylation, Schiff's reaction, electrophilic aromatic substitution in aryl amines,Schotten-Bauman reaction, reactions of amines with nitrous acid.

Synthesis and chemical reaction of aryl diazonium salts–Sandmeyer reaction, Gattermann reaction, Baltz-Sciemann reaction, Gomberg reaction, azo coupling.

UNIT IV: Nitro compounds and nitriles **(12 Hrs)**

Nomenclature-acidity of nitroalkanes-preparation of nitroalkanes and nitroarenes–chemical reactions of nitroalkanes, nitroarenes and their reduction in acid, neutral and alkaline media–Picric acid.

Nomenclature- Preparation of alkane nitriles andiso-nitriles-chemical properties.

UNIT V: Heterocyclic compounds (12 Hrs)

Nomenclature–aromaticity of five and six membered heterocyclics–furan, pyrrole, thiophen, pyridine, piperidine–methods of synthesis- chemical reactions with special emphasis on mechanism of electrophilic and nucleophilic substitutions–comparison of basicity of pyridine, piperidine and pyrrole–condensed five and six membered heterocyclics- indole, quinoline, isoquinoline–synthesis with special reference to Fischer-indole, Skraup, Beisler-Napieralski synthesis-mechanism of electrophilic substitution reaction of the above.

Textbook:

1. Jain. M.K. and Sharma. S.C., Textbook of Organic Chemistry, Vishal publishing Co, 4th edition, 2014.

References:

1. Morrison and Boyd., Organic Chemistry, Pearson publication, 7th edition, 2003.
2. Mehta. B. and Mehta.M., Organic Chemistry, Prentice–Hall of India Private limited, 2007.
3. Soni. P.L. and Chawla. H.M.,Textbook of Organic Chemistry , Sultan Chand and Sons, 28th edition, 2007.
4. Finar. I.L., Organic Chemistry, ELBS publication, 7th edition, 1998.

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
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K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying	**X**	**X**	**X**		**X**
K4: Analyzing	**X**	**X**			**X**
K5: Evaluating					
K6: Creating					

SEMESTER-IV ***CORE Theory***

CHE 2524/CHS 2524 **Inorganic Chemistry- IV** ***5 hrs/5 cr***

Course Objectives:

The objective of the course is to provide an in-depth knowledge of transition elements. This will enable the students to understand the details of bonding, reactivity, applications of coordination compounds and inorganic polymers.

Course Outcome:

At the end of the course the students will be able to

1. illustrate transition properties, differentiate transition series and describe the metallurgy
2. name coordination compounds, determine structure from physical measurements and explain stability and isomerism in coordination compounds
3. describe and apply theories of bonding in coordination compounds.
4. write the preparation, discuss the properties, structure and uses of transition metal compounds
5. explain the properties and uses of inorganic polymers.

UNIT I: d-Block elements **(12 Hrs)**

An introduction to the transition elements–electronic configuration–metallic character–variable valency–oxidation states–size of atoms–density–melting point–boiling point–reactivity–ionization energy–magnetic properties–color–catalytic properties-differences between first , second and third row transition elements–metallurgy of Cr, Fe, Ni and Au.

UNIT II: Coordination chemistry-I **(12 Hrs)**

Double salts–coordination compounds–coordination number and geometries–nomenclature–Werner's theory–physical methods in the study of complexes–stability of complex ions–step-wise and overall stability constants–chelate effect–isomerism in coordination compounds–application of complexes.

UNIT III: Coordination chemistry-II **(12 Hrs)**

Bonding in complexes–Valence bond theory–shortcomings–Crystal field theory as applied to octahedral and tetrahedral complexes–CFT and magnetic properties -factors affecting CFSE–spectrochemical series–application of CFT- drawbacks–Jahn-Teller effect–term symbols–Orgel diagrams and electronic spectra of d^1 and d^9 ions.

UNIT IV: Chemistry of transition metal compounds **(12 Hrs)**

Titanium tetrachloride- vanadium pentoxide–chromous acetate–peroxo compounds of chromium–potassium dichromate–tungsten bronzes–tungsten blues–potassium permanganate–potassium ferrocyanide–Prussian blue- sodium nitroprusside–nickel-dmg complex–halides of silver–forms of Pt and Au–verdigris–mercurous compounds–Nessler's reagent–alloys of Cu and Ni.

UNIT V: Inorganic polymers **(12 Hrs)**

Definition–special characteristics–glass transition temperature–solubility–classification–preparation, properties and uses of–boron nitride–silicones– polymeric sulphur nitride, chalcogenic glasses–polyphosphazene–borophosphate glass–coordination polymers– volan, quilon, metallophthalocyanine–factors affecting the formation of coordination polymers.

Textbook:

1. Puri. B.R., Sharma. L.R. and Kalia. K.C., Principles of Inorganic Chemistry, Milestone Publishers, 2012.

References:

1. Lee. J.D., Concise Inorganic Chemistry, Chapman & Hall, 5th edition, 2000.
2. Cotton. F.A., Wilkinson. G. and Paul. L.G., Basic Inorganic Chemistry, John Wiley and Sons, Singapore, 3rd edition, 2004.

3. James. E. Huheey, Keiter. E.A., Keiter. R.L., Inorganic Chemistry, Pearson Education (Singapore), Delhi, 4th edition, 2005.
4. Gopalan. R. and Ramalingam. V., Concise Coordination Chemistry, Vikas Publishing House, 2010.
5. Bhagi. A.K. and Chatwal. G.R., Inorganic Polymers, Himalaya Publishing House, Mumbai, 1st edition, 2001.

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying	**X**	**X**	**X**		
K4: Analyzing	**X**	**X**			
K5: Evaluating					
K6: Creating					

SEMESTER-IV ***CORE/ Theory***

CHE 2516/CHS 2516 **Physical Chemistry–III** ***5 hrs/5 cr***

Course Objective:
This course deals with electro chemistry, chemical kinetics, catalysis and ionic equilibrium. It also provides the student an overview of fuel cells.

Course outcome:
At the end of the course, students will be able to

1. Explain the basic principles and applications of electrical conductance
2. Classify cells and calculate(solve problems related to) EMF of various electrodes
3. Derive(Compute) various rate orders, describe theories of reaction rates and evaluate thermodynamic parameters
4. Discuss(Illustrate) kinetics of reactions in solution and homogeneous catalysis
5. Derive and calculate(solve problems related to) various ionic equilibrium properties along with its applications

UNIT I: Electro Chemistry-I (12 Hrs)
Electronic and electrical conductance–Faraday's laws of electrolysis–conductance–cell constant–specific conductance–equivalent conductance–ionic mobility–Hittorf's theory– transport number–and its determination–Kohlrausch's law and its application–applications of conductance measurements–Debye-Huckel theory of strong electrolytes–Onsager equation(no derivation)–Debye-Falkenhagen effect and Wein effect–Activity and activity coefficient– ionic strength–Debye-Huckel Liming Law (no derivation).

UNIT II: Electro Chemistry–II (12 Hrs)
Reversible and irreversible cells–EMF measurements–change in free energy and EMF–other thermodynamic parameters from EMF data–standard electrode potential–electrochemical series–various types of electrodes– metal, metal insoluble salts, gas and redox electrodes–chemical and concentration cells with and without transference–liquid junction potential and its determination–applications of EMF measurements–fuel cells and its construction and applications–overvoltage–determination of overvoltage–corrosion and passivity of metals–commercial cells and their principles.

UNIT III: Chemical Kinetics–I (12 Hrs)
Order and molecularity of a reaction–rate constant–factors influencing rate of a reaction–experimental determination of reaction rates–first order, second order, third order and zero order reactions–half-life periods–methods of determining order of a reaction– equilibrium and steady state approximation– effect of temperature on reaction rates–activation energy and its determinations–Arrhenius equation–theories of reaction rates–collision theory and its importance– evaluation of thermodynamic parameters.

UNIT IV: Chemical Kinetics–II and Catalysis (12 Hrs)
Lindemann theory of unimolecular reaction–consecutive and opposing reactions–chain reactions–Bronsted–Bjerrum equation–fast reactions–stop flow method–catalysis–types of catalysis–homogeneous and heterogeneous catalysis–characteristics of catalytic reactions–promoters–catalytic poisoning–negative catalysis–auto catalysis–activation energy and catalysis–theories of catalysis–generalized acid–base catalysis–enzyme catalysis– characteristics of enzyme catalysis.

UNIT V: Ionic Equilibrium (12 Hrs)
Various concepts of acid and bases–dissociation of polybasic acids–pH scale– common ion effect–buffer solution– buffer capacity–Henderson's equation–hydrolysis of salts–relationship between K_b, K_a and K_w–degree of hydrolysis–acid-base indicators–theory of indicators–solubility–solubility product and its applications.

Textbook:

1. Puri. B.R., Sharma. L.R. and Pathania. M.S., Principles of Physical Chemistry, Vishal Publishing Co., 2014.

References:

1. Castellan. G.W., Physical Chemistry, Addison-Wesley, 3rd edition, 1983.
2. Atkins. P.W. and De Paula. J., Physical Chemistry, Oxford University press, 8th edition, 2008.
3. Glasstone. S., A Textbook of Physical Chemistry, Macmillan(India) Ltd, 1976.
4. D.R. Crow, Principles and Applications of Electrochemistry, CRC Press , 4th Edition, 1994
5. Laidler.J, Chemical Kinetics, Pearson Education India, 3rd edition, 1987

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying		**X**	**X**		**X**
K4: Analyzing					
K5: Evaluating					
K6: Creating					

SEMESTER-IV ***CORE Lab***

CHE 2432/CHS 2432 Organic Estimation and Gravimetric Analysis ***4 hrs/4 cr***

Course Objectives:

In this course students will be trained in the quantitative estimation of organic compounds like glucose, phenol, aniline, amino acids and formaldehyde and the gravimetric estimation of cations. This course also includes purification techniques of organic compounds.

Course Outcome:

At the end of the course, the students will acquire skill to:

1. Estimate the organic compounds quantitatively
2. Prepare and purify organic compounds
3. Perform effective precipitation
4. Estimate cations quantitatively by weighing
5. Analyse biological samples and preservatives quantitatively.

I–ESTIMATION OF ORGANIC COMPOUNDS

- Aniline/ Phenol
- Glucose
- Glycine
- Formaldehyde

II–PREPARATION OF ORGANIC COMPOUNDS

- Benzoic Acid
- Oxime

III–GRAVIMETRIC ESTIMATION OF CATIONS

- Ba^{2+} as barium chromate
- Pb^{2+} as lead chromate
- Ca^{2+} as calcium oxalate
- Ni^{2+} as Ni-DMG
- Cu^{2+} as copper thiocyanate

References:

1. B. S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, Vogel's textbook of Practical Organic Chemistry, Pearson, 5th edition, 1989.
2. N.S. Gnanpragasam and G. Ramamurthy, Organic Chemistry Lab Manual, S. Viswanathan Pvt. Ltd.
3. A. I. Vogel, "Quantitative Inorganic Analysis", ELBS, 3rd Edition, 1971.

Mapping of Bloom's Taxonomy with Course Outcome					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying	**X**	**X**	**X**	**X**	**X**
K4: Analyzing				**X**	**X**
K5: Evaluating					
K5: Evaluating					
K6: Creating					

SEMESTER-IV *MAJOR SUPPORTIVE* **(Theory)**

CHE2382/CHS 2382 CHEMISTRY FOR PHYSICISTS – II ***3 hrs/3 cr***

Course Objective:

This course deals the basics of chemical kinetics, thermo-chemistry, coordination chemistry, stereochemistry and gave elementary ideas on carbohydrates, amino acids and proteins.

Course Outcome:

At the end of the course, the students will be able to

1. Explain reaction rate parameters and Michaelis-Menten hypothesis
2. Define enthalpies of various reactionsand explain Hess's law
3. Apply the concepts of co-ordination chemistry to explain properties and applications of coordination complexes
4. State and analyze the stereochemistry of organic compounds
5. Classify amino acids, proteins, carbohydrates, explain their properties and applications

THEORY COMPONENT (3hrs / week)

UNIT I: Chemical Kinetics and Catalysis (8 Hrs)

Rate, order and molecularity of a reaction–rate constant–rate equations–First, second and zero order reactions–half life time of a reaction–methods of determining order of a reaction–effect of temperature on reaction rate–activation energy–Arrhenius equation–Catalysis–enzyme catalysis–Michaelis-Menten hypothesis and its applications.

UNIT II: Thermochemistry (8 Hrs)

Internal energy changes in a chemical reaction–Changes of enthalpy in a chemical reaction–enthalpy of reaction at constant volume and at constant pressure–enthalpy of combustion, neutralization, dissociation, formation–Kirchoff's equation–Hess's law and its applications–Bomb Calorimeter.

UNIT III: Co-ordination Chemistry (8Hrs)

Coordination compounds–shapes of d-orbitals–Werner's theory–coordination number–important ligands–nomenclature–concept of EAN–Pauling's theory–CFT–CFSE–crystal field splitting in Octahedral field–spectrochemical series–chelation–application of complexes in qualitative–volumetric and gravimetric analysis.

UNIT IV: Stereochemistry (8 Hrs)

Stereochemistry and stereoisomerism–tetrahedral carbon–optical activity–plane polarized light–polarimeter–specific rotation–chiral centres–enantiomers and optical activity–specification of R and S configurations–diastereomers–meso structures–racemic modification–resolution–Geometrical isomers–E/Z nomenclature.

UNIT V: Carbohydrates, Amino acids and Proteins (8 Hrs)

Classification of carbohydrates–Monosaccharide–Glucose, fructose–preparation, properties and structure (no structure elucidation)–mutarotation–Disaccharide–sucrose–properties, preparation and structure–General study of polysaccharides–Starch and cellulose.

Classification and preparation of amino acids–general reactions–Dipeptides–synthesis–structure and types of proteins.

References:

1. R. Chang, Chemistry, Tata-McGraw Hill, 1st Indian Edition, 2007.
2. R. Gopalan & S. Sundaram, Fundamentals of Chemistry, Sultan Chand and Sons, 1988
3. B. R. Puri, L. R. Sharma & K. C, Kalia Principles of Inorganic Chemistry, Shobanlal Nagin Chand and Co, 1995.
4. R. Gopalan, & S. Sundaram, Allied Chemistry, Sultan Chand and Sons, 1993.
5. B. R. Puri, L. R. Sharma, & K. C. Kalia, Principles of Physical Chemistry, Vishal Publications, 1998.

6. P. L. Soni, Textbook of Organic Chemistry, Sultan Chand & Sons, 1998.

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding	**X**	**X**	**X**	**X**	**X**
K3-Applying			**X**		**X**
K4-Analyzing					
K5-Evaluating					
K6-Creating					

SEMESTER-IV ***MAJOR SUPPORTIVE*****(Theory)**

CHE 2384 CHEMISTRY FOR ZOOLOGISTS – II *3 hrs/3 cr*

Course Objective:

This course deals with chemical kinetics, catalysis, spectral techniques, and metals in biology. It also deals with basic organic reactions and purification methods.

Course Outcome:

At the end of the course, the students will be able to

1. Classify and explain reagents, intermediates and reactions
2. Discuss the reaction parameters and catalysis
3. Explain the role of elements in biology
4. Illustrate purification techniques
5. Illustrate the principles and applications of UV-Vis, IR, NMR and mass spectroscopy techniques.

THEORY COMPONENT [3hrs / week]

UNIT–I Basic Organic Chemistry (8 Hrs)

Types of bond fission–Reagents–electrophile, nucleophile, free radical–Reactive intermediates and their stability–carbocations, carbanions, free radicals–Types of organic reactions–substitution, addition, elimination, oxidation, reduction and rearrangement reactions.

UNIT–II Chemical Kinetics and Catalysis (8 Hrs)

Reaction rate–Order and Molecularity– determination of order,half-life period and its application in biology–Enzyme catalysis–Michaelis-Menton kinetics–Inhibition–Bio- chemical applications–Catalysis and Activation energy–thermodynamic and kinetic control.

UNIT–III Metals in Biology (8 Hrs)

Essential and Non-essential elements–Biological role–Hemoglobin, Vitamin B_{12}. Chlorophyll, Ion pump–Medicinal role–Calcium, Platinum, Lithium, Silver, Gold –Metal toxicity–Mercury, Lead, Chromium.

UNIT–IV Purification of Organic Compounds (8 Hrs)

Criteria for purity–Effect of impurity on physical properties and their application in biology–Methods of purification and their basis–Crystallization, Sublimation, Extraction with solvent, Soxhlet, Distillation–Simple, Steam, Fractional and Reduced pressure–Chromatography–Column, TLC and Paper.

UNIT–V Basic Spectral Techniques (8 Hrs)

Electromagnetic Spectrum–quantization of energy– regions of the spectrum– UV-Vis, spectrophotometry–Beer-Lambert law, electronic transition, spectral representation, chromophore and uses in biology–Infra red spectrophotometer–molecular vibrations, infrared spectrum and uses in biology–NMR–nuclear spin, nuclei with spin, NMR spectrum, chemical shifts, coupling constants, relaxation and applications in biology–Mass spectrometry–basic experiment, ion analysis, mass spectrum and ionization techniques.

Text book:

1. J.Fisherand J.R.P. Arnold, Instant notes in chemistry for biologists, Viva Books Private Ltd., Series editor B.D.Hames- Bio Scientific Publishers Ltd., 2002

References:

1. M. K. Jain & S. C. Sharma, Modern Organic Chemistry–Vishal publishers, 2014
2. P. K. Bhattacharya, Metal Ions in Biochemistry, Narosa Publishing House Pvt.Ltd., 2005

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**

K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding	**X**	**X**	**X**	**X**	**X**
K3-Applying	**X**				
K4-Analyzing					
K5-Evaluating					
K6-Creating					

SEMESTER IV **MAJOR SUPPORTIVE(Lab)**

CHE 2182/ CHS 2182 CHEMISTRY LAB FOR PHYSICISTS–II 2 hrs/ 1 cr

Course objectives:

Main objective of this program is to encourage more hands-on training to undergraduate students by adding more individualized practical exercises Also this course is intended for students to qualitatively analyze the simple salts containing the following cations and anions. This course is also supported by STAR college programme.

Course Outcome:

At the end of the course, the students should be able to

1. Identify interfering acid radicals
2. Eliminate interfering anion
3. Perform a systematic analysis and identify the cations
4. Determine quality parameters of environmental samples and food products
5. Perform extraction of natural products

Experiments

1. Analysis of Salt-I
2. Analysis of Salt-II
3. Analysis of Salt-III
4. Analysis of Salt-IV
   (Cations: Pb(II), Cu(II), Cd(II), Bi(III), Fe(II), Mn(II), Ni(II), Co(II), Zn(II), Mg(II) & NH^{4+} Interfering Anions: Oxalate, tartrate, borate, fluoride, and phosphate)
5. Analysis of Ozone& CO_2 in air sample
6. Estimation of available nitrogen in soil samples
7. Estimation of available phosphorus in soil samples
8. Estimation of Borax in soil samples
9. Extraction, isolation and characterization of natural products
10. Measurement of density of various commercial milk samples.
11. Determination of fat content in milk and milk products.
12. Separation of cream from whole milk using cream separator

Extension activity:

Industrial visits to milk industry/ polymer industry/ beverage industry/ sugarecane industry

References:

1. V. V. Ramanujam, Inorganic Semimicro qualitative analysis, National Publishing company, Madras, 1974
2. Lab Manual prepared by Department of chemistry

Mapping of Bloom's Taxonomy with Course Outcome					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding		**X**	**X**	**X**	**X**
K3-Applying		**X**	**X**	**X**	**X**
K4-Analyzing				**X**	
K5-Evaluating					
K6-Creating					

SEMESTER IV **MAJOR SUPPORTIVE(Lab)**

CHE 2184 CHEMISTRY LAB FOR ZOOLOGIST–II [2 hr/ 1 cr]

Course objectives:

Main objective of this program is to encourage more hands-on training to undergraduate students by adding more individualized practical exercises Also this course is intended for students to qualitatively analyze the simple salts containing the following cations and anions. This course is also supported by STAR college programme.

Course Outcome:

At the end of the course, the students should be able to

1. Identify interfering acid radicals
2. Eliminate interfering anion
3. Perform a systematic analysis and identify the cations
4. Determine quality parameters of environmental samples and food products
5. Perform extraction of natural products

Experiments

1. Analysis of Salt-I
2. Analysis of Salt-II
3. Analysis of Salt-III
4. Analysis of Salt-IV
   (Cations: Pb(II), Cu(II), Cd(II), Bi(III), Fe(II), Mn(II), Ni(II), Co(II), Zn(II), Mg(II) & NH^{4+} Interfering Anions: Oxalate, tartrate, borate, fluoride, and phosphate)
5. Analysis of Ozone& CO_2 in air sample
6. Estimation of available nitrogen in soil samples
7. Estimation of available phosphorus in soil samples
8. Estimation of Borax in soil samples
9. Extraction, isolation and characterization of natural products
10. Measurement of density of various commercial milk samples.
11. Determination of fat content in milk and milk products.
12. Separation of cream from whole milk using cream separator

Extension activity:

Industrial visits to milk industry/ polymer industry/ beverage industry/ sugarecane industry

References:

1. V.V.Ramanujam, Inorganic Semimicro qualitative analysis, National Publishing company, Madras, 1974
2. Lab Manual prepared by Department of chemistry

Mapping of Bloom's Taxonomy with Course Outcome					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding		**X**	**X**	**X**	**X**
K3-Applying		**X**	**X**	**X**	**X**
K4-Analyzing				**X**	
K5-Evaluating					
K6-Creating					

Curriculum

for

Third Year B.Sc Chemistry (AIDED & SF) Programme

(For those who were admitted from the academic year 2015-2016 onwards)

SEMESTER V

Since 1881

Undergraduate Department of Chemistry

The American College

(An Autonomous Institution Affiliated to Madurai Kamaraj University)

Madurai, Tamilnadu, INDIA

SEMESTER- V *CORE/ Theory*

CHE 3611/CHS 3611 ORGANIC CHEMISTRY – IV *6 hr / 6 cr*

Course Objectives:

The primary objective of this course is to learn and appreciate the role of chemistry in nature. It is designed to systematically study the various biological aspects pertaining to proteins, enzymes, lipids, nucleic acids, carbohydrates, alkaloids and terpenoids.

Course Outcome:

At the end of the course, students will be able to:

1. Describe the structure, classification and stereochemistry of amino acids, proteins and enzymes.
2. Discuss and distinguish the composition of nucleic acids and lipids.
3. Classify carbohydrates, analyze their structure and explain the reactions of mono, di and polysaccharides
4. Identify the general methods structural elucidations and apply them to elucidate the structure of alkaloids.
5. State general rules applicable to terpenoids and apply them for structural elucidation.

Unit – I Proteins and Enzymes 15 hrs

Aminoacids – classification, structure and stereochemistry – Zwitter ion – isoelectric point – electrophoresis – preparation and reaction of amino acids – structure and Nomenclature of peptides and proteins – classification – determination of structure of peptide – end group analysis – classical peptide synthesis – solid phase peptide synthesis – protein structure (1^o, 2^o, 3^o and 4^o) – protein denaturation and renaturation.

Enzymes – specificity – prosthetic group – co-enzyme, apoenzyme, holoenzyme, co-factor – nomenclature and classification of enzyme – typical enzymes – sources – mode of enzyme action – enzyme inhibition – application of enzymes.

Unit – II Nucleic acids and Lipids 15 hrs

Constituents of nucleic acids – bases, sugars, nucleotides, nucleosides – laboratory synthesis of nucleosides and nucleotides – DNA, RNA – genetic code and heredity.

Lipids – classification – oils and fats – structure, chemical reactions, physical characteristics, rancidity, acid value, saponification value, iodine value, RM value, hydrogenation of oil

Unit – III Carbohydrates 15 hrs

Classification and nomenclature – monosaccharide and their configuration – erythro and threo – diasteromers – epimers – anomers – cyclic structure of monosaccharides – determination of ring size – mechanism of mutarotation – glycosides and their hydrolysis – formation of ethers and esters – reducing and non – reducing sugars – mechanism of osazone formation – interconversion of aldoses and ketoses – ascending and descending the sugar series – an introduction to disaccharide (sucrose, maltose and lactose) and polysaccharide (starch and cellulose).

Unit – IV Alkaloids 15 hrs

Nomenclature and classification – occurrence and extraction – general methods of structural elucidation of Coniine, Nicotine, Piperine and Atropine.

Unit – V Terpenoids 15 hrs

Occurrence of terpenoids – classification – isoprene rule – structural elucidation of Citral, Limonene, Menthol and Camphor.

Text Book:

1. M.K. Jain and S.C. Sharma, Textbook of Organic Chemistry, Vishal publishing Co, 2012, IV (Revised edition).

Reference:

1. R. T. Morrison & R. N. Boyd, Organic Chemistry, Pearson publication, 7th edition, 2012.
2. B. Mehta & M. Mehta, Organic Chemistry, Prentice – Hall of India Private limited,2007.
3. P. L. Soni & H. M. Chawla,Textbook of Organic Chemistry, Sultan Chand and Sons, 28th edition, 2007.
4. I. L. Finar, Organic Chemistry, Vol.I, ELBS publication, 6th edition, 2002.

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying		**X**	**X**	**X**	**X**
K4: Analyzing		**X**	**X**		
K5: Evaluating					
K6: Creating					

SEMESTER- V *CORE Theory*

CHE 3613/CHS 3613 INORGANIC CHEMISTRY-V *6 hrs / 6 cr*

Course objectives:

This course exposes the students to the developing areas of organometallic catalysis, reactions & mechanism of coordination compounds and bioinorganic chemistry. It also imparts knowledge about f-block chemistry, radioactivity and nuclear reactions**.**

Course Outcome:

At the end of the course the students will be able to

1. explain preparation, properties, structural features and stability of π-donor andπ-acceptor complexes
2. discuss reaction mechanism of coordination compounds, apply trans effect for synthesis and outline catalytic cycles
3. describe the structure & functioning of biomolecules and role of metals in biology
4. explain extraction and properties of f-block elements
5. outline the nuclear properties and its applications and calculate nuclear energies.

Unit – I Organometallic chemistry 15 hrs

Organometallic ligands – types of organometallic compounds – organometallic compounds of group 12 – 15 elements – metal complexes with pi – acceptor ligands – π acidity – metal carbonyls – types – EAN rule – theoretical basis – synthetic methods, reactivities, structure and bonding in $Ni(CO)_4$, $Fe(CO)_5$, $Cr(CO)_6$, $Co_2(CO)_8$ and $Mn_2(CO)_{10}$ – synergism – vibrational spectra – mixed carbonyls – compounds with multinuclear centres – alkene complexes – carbocyclic systems – ferrocene – preparation, properties, structure and bonding (VB explanation).

Unit – II Reactions and mechanism of coordination compounds. 15 hrs

Lability and inertness – interpretation in terms of VBT – acid hydrolysis of octahedral complexes – S_N1 and S_N2 mechanism – factor influencing – base hydrolysis of octahedral complexes – S_N1CB mechanism – evidences – stereochemistry of intermediate of base hydrolysis – trans effect – π-bond theory – applications – transition metal complexes as catalyst – Wilkinson's catalyst – Ziegler-Natta catalyst – their catalytic cycles.

Unit – III Bioinoganic chemistry 15 hrs

Essential and non – essential metals – oxygen carriers – hemoglobin, myoglobin, hemocyanin – metalloenzymes – cyanocobalamine – carbonic anhydrase ,cytochrome P-450 – role of alkali metals – sodium ion pump – alkaline earth metals – toxicity of Hg, Pb, Cr – metals in medicine and diagnosis – chelate therapy, invivo fixation of nitrogen.

Unit – IV f – Block elements 15 hrs

Lanthanide series – occurrence – properties – electronic configuration, oxidation state – ionic radii – lanthanide contraction – colour , spectra, magnetic properties – complexes of lanthanides – separation of lanthanides – Actinide series – transuranic elements – properties – electronic configuration, oxidation state, ionic radii, colour – comparison with lanthanides – extraction of thorium– extraction of uranium – compounds of uranium – uses of lanthanides – plutonium as source of energy.

Unit – V Nuclear chemistry 15 hrs

Nuclear particles – nuclear forces – packing fraction – mass defects and binding energy of nucleus – stability of nucleus – nuclear models – liquid drop model – nuclear reactions – Q values – spallation – nuclear fission – atomic bomb – the concepts of critical mass – nuclear fusion – Hydrogen bomb – radioactivity – artificial transmutation – half life period – radioactive displacement laws – modes of decay – applications of radioactivity – nuclear reactors – measurement of radioactivity – GM counter – Wilson cloud chamber – nuclear accelerator – cyclotron.

Text book:

1. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers (2012)

References:

1. Lee. J.D, Concise Inorganic chemistry, V edition, Chapman & Hall Ltd, London ,2000

2. Cotton F.A., Wilkinson G., Basic Inorganic Chemistry, III Edition, John Wiley & Sons, Singapore, 2004
3. James. E. Huheey., Keiter E.A., Keiter R.L, Inorganic chemistry, IV edition, Pearson Education, (Singapore), Delhi, 2005
4. Gopalan R., Ramalingam V, Concise Coordination Chemistry, Vikas Publishing house, New Delhi, 2006
5. Hay R.W, Bioinorganic Chemistry, Ellis Horwood,1984
6. Bertini, Lippard, Gray, Bioinorganic Chemistry, Viva Book Pvt. Ltd ,1998
7. Arniker H .J., Essentials of Nuclear Chemistry, IV Edition, New Age International Ltd., New Delhi ,1995

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying	**X**	**X**			**X**
K4: Analyzing					
K5: Evaluating					
K6: Creating					

SEMESTER- V *CORE/ Theory*

CHE 3615/CHS 3615 PHYSICAL CHEMISTRY – IV ***6 hrs / 6 cr***

Course Objectives:
This course provides basic information regarding classical and quantum mechanical treatment of atom and nature &behavior of light. Nano chemistry gives an overall view on the concepts and applications in day today life. Outline on the macromolecule is dealt along with various methods of analysis of the same. Along with introducing phase rule, examples of each system have been covered.

Course outcome:
At the end of the course, students will be able to

1. Analyze the classical mechanism principle which led to quantum mechanics
2. Apply the properties such as operators and eigen values to solve the appropriate Schroedinger equation
3. Classify the types of polymers and determine the molecular weight of polymers
4. Analyze the phase diagrams of systems
5. Illustrate various nanomaterials and their applications

Unit – I Quantum Mechanics – I 15 hrs

Dual nature of light – photoelectric effect, Compton effect – dual nature of electron – de Broglie relationship – Davison and Germer experiment – Heisenberg's uncertainty principle – Electron, Charge, Mass – Milliken's oil drop technique – Rutherford's experiment – Mosley's experiment – Rutherford's model – Radiant energy – electromagnetic spectrum – black body radiation – Plank's distribution law – hydrogen spectrum – Ritz combination principle – Bohr's model of hydrogen atom and their comparison – Sommerfeld's extension of Bohr theory – failure of Sommerfeld theory.

Unit – II Quantum Mechanics – II 15 hrs

Time independent Schrödinger equation – Postulates of quantum mechanics – Operators in quantum mechanics – interpretation of wave function – operators – eigen values – orthonormal function – discussion of particle in a box problem (1D and 3D) – rigid rotor – simple harmonic oscillator(no derivation) – Bohr's correspondence principle – hydrogen atom problem – Schrödinger equation in polar coordinates – separation of variables – electron spin – Zeeman effect – spherical harmonics – radial distribution curve

Unit – III Macromolecules 15 hrs

Different types of polymers – classification of polymers – molecular weight of polymers – number average and weight averages – determination of molecular weight of polymer – viscosity, osmotic pressure – ultracentrifuge, sedimentation methods and light scattering methods – Conducting polymers: elementary ideas – polyacetylene, poly anilines.

Unit – IV Phase Diagram 15 hrs

Introduction – terminology – Gibb's phase rule and its derivation – one component system – water, sulphur, helium systems – freezing point curves – two component system – simple eutectic systems – Lead-Silver, Potassium Iodide-water system – two component system with compound formation – congruent and incongruent melting points – Zn-Mg, Ferric Chloride-water, sodium sulphate-water systems, Copper sulphate-water systems, industrial applications.

Unit – V Nano Chemistry 15 hrs

Nano and Nature – Nano: The beginning (1D, 2D and 3D) – Fullerenes – introduction – experimental set up to detect C_{60} – Carbon nanotubes – types – physical properties and applications – Difference between Langmuir Blodgett and self assembly techniques – Applications of Self assembled monolayers (SAMs) – Nanomedicines – nanoshells – nanopores – tectodendrimers

Text book:

1. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, and M. S. Pathania, 44th edition, Vishal Publishing company, 2010.

References:

1. Textbook of Physical Chemistry, P.L. Soni, O. P. Dharmarha, U.N. Dash, Sultan Chand & Sons 2016.

2. Essential of Physical Chemistry, ArunBahl, B.S. Bahl and G.D. Tli, S. Chand, 2014,
3. Physical Chemistry, G.W. Castellan, 3rd edition, Addison-Wesley, 1983.
4. Physical Chemistry, 8th edition, P.W. Atkins and J.de Paula, Oxford University press, 2008.
5. Inorganic Chemistry, 5th edition, P.W. Atkins, Oxford University press, 2009.
6. Nano: The essentials: Understanding Nanoscience and Nanotechnology, T. Pradeep, Tata McGraw Hill publishing company, 2008.

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying	**X**	**X**	**X**	**X**	
K4: Analyzing					
K5: Evaluating					
K6: Creating					

CHE 3200/CHS3200 ENVIRONMENTAL STUDIES ***4 hrs/ 2 Cr***

Course Objective:
In this course various types of pollutions, different types of pollutants and ways of controlling them will be discussed. Also deals social and environmental issues.

Course Outcome:
At the end of the course, students will be able to
1. Explain about environmental parameters
2. Describe eco-system
3. Illustrate water, soil pollution and their treatments
4. Identify air, thermal, radioactive and noise pollution
5. Explain environmental acts and human population issues, describe women and child welfare

Unit-I Introduction (10 Hrs)
Definition, scope, awareness- concept of environmental receptors, sink, pathways of pollutants speciation, environmental segments.
Composition of the atmosphere-atmospheric structure-formation of inorganic and organic particulate matters-photochemical reactions

Unit-II Ecology (10 Hrs)
Definition and kinds, biological cycles. Natural resources, renewable and non-renewable resources-food resources-mineral resources-forest resources-role of an individual in conservation of natural resources.

Unit-III Water & Soil Pollution (10 Hrs)
Source-BOD, COD, sewage treatment, primary and secondary treatment-industrial waste water treatment. Potable water and their standards. Soil pollution-treatment of soil pollution- disposal of radioactive waste

Unit-IV Air Pollution (10 Hrs)
Pollutants –particulate pollution-smog, acid rain-global warming-green house effect-metal pollution-monitoring of air pollution. Thermal and radioactive pollution-source-nuclear power plant. Noise pollution-source and effect. Noise level index

Unit- V Socio-environmental issues (10 Hrs)
Environmental act –air and water-wild life protection act-forest conservation act-issues involved in enforcement of environmental legislation. Human population and environment-population growth-variation among nations-population explosion-family welfare program-environment and human health-human rights-women and child welfare-value education-role of information technology in human health-case study.

References:
1. B.K. Sharma and H. Kaur, Environmental Chemistry, Goel Publishing House, Meerut, 1996.
2. H.Kothandaraman and G.Swaminathan. Principles of Environmental Chemistry. B.I. Publications, Chennai, India. 1997.
3. A.K.De, Environmental Chemistry. 4th Edition, New Age International (P) Ltd., New Delhi, India. 2000.
4. Abnubha Kaushik, C.P.Kaushik "Perspectives in Environmental Studies" New Age International Publishers, 3rd Edition, 2009.
5. S.S. Dara, A Textbook of Environmental Chemistry and Pollution Control, 8th Edition, S. Chand and Sons, New Delhi, 2008.

Mapping of Bloom's Taxonomy with Course Outcome					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying					
K4: Analyzing					

K5: Evaluating					
K6: Creating					

SEMESTER-V ***CORE/ Lab***

CHE3531/CHS3531 PHYSICAL CHEMISTRY LAB *5 Hrs / 5 cr*

Course Objective:
This laboratory course imparts knowledge in the various fields of physical chemistry such as adsorption, chemical kinetics, phase equilibria, potentiometric and conductivity measurements etc.

Course outcome:
At the end of the course, students will be able to

1. Demonstrate and validate theoretical concepts through experiments
2. Acquire skills in handling various instruments
3. Plan, conduct and report various experiments
4. Analyse and intepret experimental data
5. Apply the knowledge acquired for further research

Experiments

1. Equivalent conductance – verification of Onsager equation
2. Conductometry - i) Titration of strong acid Vs strong base
   ii) Titration of weak acid Vs strong base
3. Potentiometry - redox titrations
4. Validity of Freundlich adsorption isotherm
5. Kinetics of acid catalysed hydrolysis of ester
6. Kinetics of Iodination of acetone
7. Critical solution temperature – phenol- water system
8. Phase diagram - simple eutectic system
9. Transition temperature – Thermometric method
10. Heat of solution – Solubility method

REREFENCES

1. J.B. Yadav, Advanced practical Physical Chemistry, 18thEdt , Goel Publishing House, Meerut, 2000
2. B. Viswanathan and P.S. Raghvan, Practical Physical Chemistry, Viva Books Private Ltd., New Delhi, 2009
3. P.C. Kamboj, University Practical Chemistry, Vishal Publishing company, Punjab, 2011-2012
4. Saroj Kr Maity and Naba Kr Ghosh, Physical Chemistry Practical, New Central Book Agency Private Ltd., London, 2012

Mapping of Bloom's Taxonomy with Course Outcome					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying		**X**	**X**	**X**	**X**
K4: Analyzing		**X**	**X**		
K5: Evaluating			**X**		
K6: Creating			**X**		

SEMESTER- V ***LS-III***

CHE 3215/CHS 3215 MEDICINAL CHEMISTRY *3 Hrs / 2 cr*

Course objectives:

This course intended to impart knowledge about the development of drugs and the need for conversion of drugs into medicines.This course also dealt withpharmaco - kinetics, pharmacodynamics and Pharmaceutical Marketing.

Course Outcome:

At the end of the course, the students will be able to

1. Identify ideal drugs, classify drugs based on its sources chemical structure and therapeutic actions
2. Describe drugs based on their origin
3. Explain drug action
4. Writethe preparation of drugs
5. Write the strategy for marketing of drugs

Unit-1 Basic Concepts (8 Hrs)

Drug - definition- requirements of an ideal drug- history of drug development-nomenclature of drugs-classification of drugs based on Sources, Chemical structure& Therapeutic actions. – Terminologies -pharmacology, pharmacy, pharmaceutics, toxicology, chemotherapy, pharmaco-dynamics, pharmaco-kinetics.

Unit-II Need for Drugs (8 Hrs)

Deficiency, disorder and diseases - Disease causing organisms – bacteria- types, fungi, virus and their activities - differences between them-specific diseases caused by various organisms - Immunity, Vaccination - Adverse drug reactions, types and minimisation.

Unit-III Pharmaco-kinetics and Pharmacodynamics (8 Hrs)

Pharmaco-kinetics: Introduction – Absorption, distribution, metabolism & excretion (ADME) – LD_{50}, ED_{50} Therapeutic index.

Pharmaco-dynamics: Elementary treatment of drug action, mechanism- enzyme stimulation, enzyme inhibition and drug design – Lead, analog, prodrug, Significance of drug metabolism in medicinal chemistry.

Unit-IV Formulation of Drug (8 Hrs)

Need for conversion of drugs into medicine - additives and their role-classification of formulations-route wise and form wise: tablets, capsules, syrups, suspensions, powders, ointment, creams, gels, lotions, sprays suppositories, injections.

Unit-V Pharmaceutical Marketing (8 Hrs)

Manufacture, packaging, distribution and stocking. Pharmaceutical Market, Pharmacy – Channels of distribution-Wholesaler& retailer - Departmental stores& chain stores -mail order business – Drug house management.

Traits and demands of medical representatives –Salesmanship- Uniqueness of pharma selling– Theories of selling- Planning - Detailing of products.

References:

1. G L David Krupadanam, D Vijaya Prasad, K Varaprasad Rao, K L N Reddy C Sudhakar, Drugs, Universities Press, Hyderabad ,2001.
2. Graham Patrick, Instant notes – Medicinal chemistry, PragatiPrakashan Viva books (pvt) Ltd, 2002.
3. Alka& Gupta, Medicinal chemistry, PragatiPrakashan, II Edn , 2008.
4. Sekharmukhopadhyay, Pharmaceutical selling-A text book, Sterling publishers private Ltd.1997.

Mapping of Bloom's Taxonomy with Course Outcome					
Bloom's Taxonomy	**Unit-I**	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**

K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding	**X**	**X**	**X**		
K3-Applying	**X**				
K4-Analyzing					
K5-Evaluating					
K6-Creating					

Curriculum

for

Third Year B.Sc Chemistry (AIDED & SF) Programme

(For those who were admitted from the academic year 2015-2016 onwards)

SEMESTER VI

Since 1881

Undergraduate Department of Chemistry

The American College

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Madurai, Tamilnadu, INDIA

SEMESTER- VI ***CORE/ Theory***

CHE 3612/CHS 3612 ORGANIC CHEMISTRY – V ***6 hrs / 6 cr***

Course objectives:

This course is designed to study the application of basic spectroscopic techniques in structural elucidation of organic compounds. Students will be trained in theoretically analyzing the photochemical and thermal changes of organic compound. This course will also provide basic knowledge on uses and preparation of dyes, organometallic and active methylene compounds.

Course Outcome:

At the end of the course, students will be able to:

1. Compute the λ_{max} values in UV-visible spectroscopy, identify frequencies of various functional groups in IR spectra and diagnose the fragmentation pattern in mass spectra.
2. Identify and deduce the structure of organic molecule from ^{1}H and ^{13}C NMR spectrum.
3. Apply the FMO method & Woodward-Hofmann rules to predict the nature and stereochemistry of product obtained in pericyclic reactions.
4. Explain the theories of color and describe the classification, preparation and applications of dyes.
5. Discuss the synthesis of organometallic and active methylene compounds and analyze the possible applications of these compounds.

Unit-I UV, IR spectroscopy and Mass spectrometry (15 Hrs)

UV- Visible spectroscopy: Types of electronic transitions – Beer Lambert's law – terminologies used in UV Visible spectrum – selection rules – effect of conjugation – effect of solvent – Woodward – Fieser rules – dienes and enones – applications of UV – Visible spectra.

IR Spectroscopy: Selection rules – Hooke's law – different molecular transitions – factors affecting vibrational frequencies – characteristic frequencies of important functional groups – Finger print region – Examination of IR spectra.

Mass Spectrometry: Basic principle – molecular ion peak – nitrogen rule – terms used in mass spectra (m/e, $M^{+\cdot}$ etc..) – isotopic pattern – even– electron rule – general rules of fragmentation – fragmentation pattern (alkane, alcohol, alkyl halide, aryl halide, aldehyde and ketone)

Unit-II NMR spectroscopy (15 Hrs)

^{1}H NMR Spectroscopy: Theory – relaxation processes – shielding, deshielding and chemical shift – factors affecting chemical shift – peak area and proton counting – splitting of signals and coupling constants – chemical and magnetic equivalence – simple problems in ^{1}H NMR.

^{13}C NMR Spectroscopy: Basic principles – Off resonance and Broad band decoupling techniques

Unit-III Pericyclic reactions (15 Hrs)

Photochemical vs thermal reactions – MO theory – LCAO method – bonding and antibonding MO's – electronic configuration of some molecules – 1,3 – butadiene – allyl systems – benzene – Woodward – Hofmann rules – electrocylic, cycloaddition and sigmatropic reactions using FMO

Unit-IV Dyes, Color and Constitution (15 Hrs)

Color and structure – Witt theory – Quinonoid theory – Modern theory – Classification of dyes (based on structure, based on its mode of application on fabrics) – Preparation and application of dyes – Methyl orange, Congo red, Bismuth brown, Malachite green, Phenolphthalein, Eosin, Fluorescein

Unit-V Organometallic and Active methylene compounds (15 Hrs)

Organometallic reagents – organomagnesium, oganozinc, organolithium, organocopper, and organosilicon – preparation and reactions.

Reactions and synthetic applications of active methylene compounds – diethylmalonate, ethyl acetoacetate, cyanoacetic ester

Text Book:

M.K. Jain and S.C. Sharma, Textbook of Organic Chemistry, Vishal publishing Co, IV (Revised edition), 2012.

Reference:

1. Robert Thornton Morrison & Robert Neilson Boyd, Organic Chemistry, Pearson publication, 7th edition, 2012.
2. B. Mehta & M. Mehta, Organic Chemistry, Prentice – Hall of India Private limited, 2007.
3. P.L. Soni and H.M. Chawla,Textbook of Organic Chemistry , Sultan Chand and Sons, 28th edition, 2007.
4. JagMohan, Organic spectroscopy: Principles and applications, Narosa publishing House, 2nd edition, 2005

Mapping of Bloom's Taxonomy with Course Outcomes					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying	**X**	**X**	**X**		**X**
K4: Analyzing	**X**	**X**			**X**
K5: Evaluating		**X**			
K6: Creating					

SEMESTER- VI *CORE Theory*

CHE3614/CHS 3614 APPLIED CHEMISTRY *6 hrs / 6 cr*

Course objectives:

This course deals with the application of various chemical concepts in different fields. Ideas pertaining to the techniques of water treatment for domestic purpose, polymers and paints in our daily life are discussed. Also the chemistry behind fertilizers, ceramics and refractory materials will be covered. This course will enablethe students to appreciate the significance of their knowledge of chemistry in their day to day life.

Course Outcome:

At the end of the course the students will be able to

1. calculate hardness of water and explain various water softening methods
2. discuss the types & preparation of polymers and relate the properties with uses
3. outline plant nutrients & functions, explain the types, preparation and effects of fertilizers
4. describe types, properties and applications of ceramics & refractories
5. explain the constituents of paints &pigments, outline the types and characteristics of explosive materials.

Unit – I : Water Treatment **15 hrs**

Hardness of water – temporary hardness, permanent hardness – Units of hardness – Estimation of hardness – EDTA method – Estimation of total hardness – Water softening methods – Lime–Soda process, Zeolite process, Ion – exchange – Desalination – Reverse osmosis – Potability of water – Plumbosolvency – Nano filters

Unit – II : Polymers **15 hrs**

Synthetic polymers – Preparation, properties and uses of Polyethylene, PVC, Teflon, Nylon, Phenol formaldehyde, Urea Formaldehyde, Epoxy resin

Rubber – natural and synthetic – vulcanisation

Biodegradable polymers – classification – biomedical applications – medical sutures, pins, dental implants

Biostable polymers – Biomedical applications – cardiovascular applications – bones, joints, dental polymers – contact lenses and IOL – hemodializer materials – tissue engineering polymers – controlled release of drugs – polymeric blood substitutes – Nano biopolymers and application

Unit – III : Fertilizer **15 hrs**

Plant Nutrients – nutrients functions – need and requirements of fertilizers – classification – Nitrogenous fertilizers – types, preparation and uses – Phosphate fertilizers – types, preparation and uses – Potassium fertilizers – NPK fertilizers – ill effects of fertilizers – Biofertilizers – manures, compost, sawdust, biogas manures – Nano fertilizers – elementary ideas and uses

Unit – IV : Ceramics and Refractories

Ceramics – properties and types – basic raw materials – Clay – formation, types, properties – Glazing – Porcelain and China

Refractories – classification, properties – super refractories – preparation, properties and uses of Silicon carbide, graphite, oxides, Cermets, insulating refractories

Nano ceramics – elementary ideas and applications

Unit – V : Paints and Explosives **15 hrs**

Paints – classification – constituents – Pigment Volume Concentration – Distember – Varnishes – Lacquers - Pigments – name and formula of different coloured pigments and their uses – Toners – Nano paints

Explosives – classification – characteristics – chemistry of Nitrocellulose, nitroglycerine, gun powder, RDX – Toxic chemicals – important requirements – mustard gas, phosgene, nerve gas, adamsite, chloroacetophenone, chloropicrin – Screening smokes – Incendiaries - Pyrotechniques

Text book:

1. Industrial Chemistry, B.K.Sharma, 7th edition, 1995, ISBN – 8185842531, GOEL publishing house.

Reference:

1. Environmental Chemistry, A.K. De, 4th edition, 2000, New Age International (P) Ltd.
2. Applied Chemistry, K. BagavathiSundari, 2006, ISBN 818094025X, MJP publishers. (Unit – 2)
3. Contemporary Polymer Chemistry, Harry R. Allcock, Frederick W. Lampe, James E. Mark, 3rd edition, 2005, Pearson Prentice hall. (Unit – 2)
4. Fundamental Concepts of Applied Chemistry, JayashreeGhosh, 2nd edition, 2006, S. Chand publishing. (Unit – 3)

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying	**X**	**X**			
K4: Analyzing					
K5: Evaluating					
K6: Creating					

SEMESTER- VI *CORE/ Theory*

CHE 3616/CHS 3616 PHYSICAL CHEMISTRY – V *6 hrs / 6 cr*

Course Objectives:

The students get to know the principles of various spectroscopic analytical tools available for analysis of chemical compounds. Derivations of the spectroscopic methods are taught at basic level to enhance the student knowledge on the roots of these available techniques. The chemistry point of group theory is presented at the introductory level with some applications. It also covers various photo chemical pathways and their applications.

Course outcome:

At the end of the course, students will be able to

1. Apply physical parameters to derive rotational and vibrational energy for different types of molecules
2. *Discuss* Illustrate the principles of Raman, electronic and photoelectron spectroscopy and illustrate the applications of photoelectron spectroscopy
3. Explain the principle, instrumentation and applications of NMR, ESR and Mossbauer spectroscopy
4. Ascertain point group for moleculesand apply the concepts of group theory to predict the spectroscopic properties
5. To state various photochemical laws, classify photo-physical and chemical processes, and to determine the kinetics of photochemical reactions

Unit – I Spectroscopy – I 15 hrs

Molecular Spectroscopy: Introduction – regions of the spectrum – basic elements of practical spectroscopy – signal to noise ratio – resolving power – the width and intensities of spectral lines.

Microwave Spectroscopy: The rotation of the molecules – rotational spectra of diatomic molecules – linear polyatomic molecules.

IR Spectroscopy: Vibrating diatomic molecules – simple harmonic and unharmonic – diatomic vibrating rotator –Born Oppenheimer approximation – breakdown – vibrations of polyatomic molecules – overtones and combinations – analysis of IR spectra – skeletal vibrations and characteristic group vibrations – Instrumentation

Unit – II Spectroscopy – II 15 hrs

Raman Spectroscopy: Introduction – molecular polarizability – selection rules – pure rotational Raman spectra – linear molecules – vibrational Raman spectra – mutual exclusion principle – structural determination from Raman and IR spectra - nitrate, carbonate

Electronic spectra of diatomic molecules – Franck-Condon principle – dissociation constant of a diatomic molecule.

PES – principles of photoelectron spectroscopy and its applications

Unit – III Spectroscopy – III 15 hrs

NMR spectroscopy: basic principle – instrumentation – chemical shifts – spin – spin coupling **ESR spectroscopy:** basic principle – hyperfine structure – presentation of ESR spectra – nitrogen rule – g-factor – splitting – applications of ESR spectroscopy – comparison between ESR and NMR

Mossbauer Spectroscopy: introduction, principle and applications

Unit – IV Group Theory 15 hrs

Properties of a group – group multiplication table – cyclic groups – subgroups – classes – symmetry elements and operations and its relation to optical activity – symmetry point groups – identification of point groups – matrices of geometric transformations – representations of groups – reducible and irreducible representations – rules governing irreducible representation and their characteristics – relationship between reducible and irreducible representations – character tables C_{2v}, C_{3v}, C_{2h} – group theoretical selection rule in vibrational spectroscopy.

Unit – V Photochemistry 15 hrs

Photochemical and thermal reactions – comparison – Jablonski diagram – laws of photochemistry – Grotthus-Draper law – Stark- Einstein law – photochemical reactions in solution – Beer-Lambert's law – limitations – Quantum yields – Determination of Quantum yields – Photochemical rate law – kinetics of HBr and HCl formations – photochemical equilibrium – Photochemical process – secondary photochemical processes – photosensitization – Quenching – Stern-Volmer equation – photosynthesis – chemiluminescence – laser and maser – applications of laser

Text book:

1. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, and M. S. Pathania, 44th edition, Vishal Publishing company, 2010.

References:

1. Textbook of Physical Chemistry, P.L. Soni, O. P. Dharmarha, U.N. Dash, Sultan Chand & Sons 2016.
2. Essential of Physical Chemistry, ArunBahl, B.S. Bahl and G.D. Tuli, S. Chand, 2014.
3. Physical Chemistry, G.W. Castellan, 3rd edition, Addison-Wesley, 1983.
4. Physical Chemistry, 8th edition, P.W. Atkins and J.De Paula, Oxford University press, 2008.
5. Fundamentals of Molecular Spectroscopy, 4th edition, C. N. Banwell, Tata McGraw Hill publications, 1995.
6. Chemical applications of Group theory, 3rd edition, F.A. Cotton, Wiley, 1990.

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying	**X**			**X**	**X**
K4: Analyzing				**X**	**X**
K5: Evaluating					
K6: Creating					

SEMESTER VI **MAJOR CORE**
CHE 3534/CHS 3534 **PROJECT** **5hrs/ 5 cr**

Course Objectives:
This course is designed to reinforce the concepts with analytical techniques. It will provide a platform for students to have a hands-on experience with instruments and present a report on a research topic.

Course outcome:
At the end of the course, students will be able to

1. Analyze a research topic
2. Acquire analytical skills
3. Apply the practical skill and knowledge
4. Design a method for analysis/synthesis
5. Present a report of their findings

Group project

Students will be divided into group of five. As a group, students will do the project work on a title approved by the respective project supervisor. Students will maintain daily records and present oral reports while doing the project. All the above process will be duly assessed by the project supervisor. They will submit the project report at the end of the semester.

Evaluation

Project presentation	25 marks
Project progress	50 marks
Project Report	25 marks

Mapping of Bloom's Taxonomy with Course Outcome					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1: Remembering	**X**	**X**	**X**	**X**	**X**
K2: Understanding	**X**	**X**	**X**	**X**	**X**
K3: Applying	**X**		**X**	**X**	**X**
K4: Analyzing	**X**			**X**	**X**
K5: Evaluating				**X**	**X**
K6: Creating				**X**	**X**

SEMESTER- VI *LS-IV*

CHE 3216 DAIRY AND DAIRY PRODUCTS ***3 hrs / 2 cr***

Course objectives:

This course enriches the student's understanding about the milk and the various techniques involved during the processing and preservation of milk. This course also deals with various dairy products such as special milk, milk derivatives, and fermented milk products derived from milk.

Course Outcome:

At the end of the course, the students will be able to

1. Describe physical properties, composition, structure and constituents of milk
2. Discuss the microbiology of milk and various pasteurisation techniques
3. Explain composition, chemistry of milk derivatives and Identify the common adulterants in ghee
4. Define and construct the flow chart for manufacturing various kinds of special milks
5. Describe various milk products

Unit – I Composition of milk 8 hrs

Composition and structure of milk – constituents of milk – lipids, proteins, carbohydrates, vitamins and minerals – – Properties of milk – odour,density,viscosity,optical properties, acidity, freezing point – Recknagel's effect – estimation of fats and total solids in milk

Unit – II Milk processing and preservation 8 hrs

Microbiology of milk – Destruction of microorganism in milk – pasteurisation –types of Pasteurisation – bottle, Batch and HTST – ultra high temperature pasteurisation – preservatives and neutraliser

Unit – III Milk Derivatives 8 hrs

Cream – composition – chemistry of creaming process
Butter – composition – desibutter – salted butter
Ghee – major constituents – common adulterants added to ghee and their detection – rancidity – definition – prevention – antioxidants

Unit – IV Special Milk 8 hrs

Definition – merits – flow diagram for manufacturing – reconstituted milk – homogenised milk – flavoured milk – vitaminised milk – toned milk – imitation milk – condensed milk – definition, composition and nutritive value

Unit V – Milk products 8 hrs

Fermented milk products – definition of culture – cultured cream – cultured butter milk – cheese – unripened cheese – ripened cheese – paneer – yohurt and mazzorola cheese
Ice cream – types – ingredients – manufacture – stabilizer – emulsifiers and their role
Milk powder – skimmed milk powder – whole milk powder – buttermilk powder – types of drying process

References:

1. Sukumar De, Outlines of Dairy Technology, Oxford University Press, New Delhi, 2001
2. Lillian Hoagland Meyer, Food Chemistry, CBS Publishers, New Delhi.2004

Mapping of Bloom's Taxonomy with Course Outcome					
	Unit-I	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding	**X**	**X**	**X**	**X**	**X**
K3-Applying					
K4-Analyzing					
K5-Evaluating					
K6-Creating					

SEMESTER- VI ***LS-IV***

CHS 3218 FOOD PROCESSING AND PRESERVATION ***3 hrs / 2 cr***

Course objectives:

This course aims at enabling the students to realize the scope of food processing industry in India. It deals with various food additives, flavours, food colours and role of enzymes in food industry. This course includes the various food processing, preservation techniques and canning of fruits and vegetables.

Course Outcome:

At the end of the course, the students will be able to

1. Explain the scope of fruit and vegetables preservation and properties of enzymes
2. Classify food additives and predict the components of flavour
3. Illustrate the natural colouring matters give examples for food spoilage and predict the characteristics and storage conditions of food
4. Explain the principles and methods of preservation and the process of canning
5. Apply the drying techniques and quality control in food processing

Unit-1 (8 Hrs)

Introduction – history of preservation and canning industry- scope of fruit and vegetable preservation in India - product mix-availability - man power-capital- lack of awareness-marketing facilities – transport facilities-availability of containers – publicity -role of Government.

Enzymes in the food industry- important properties of enzymes in fruit and vegetable technology – enzymes used in the food industry- immobilized enzymes.

Unit-II (8 Hrs)

Food additives - functions and uses of food additives -classification of food additives - B.V.O - substances prohibited in foods-additives to be used with caution

Flavours - flavour compounds – flavonoids – terpenoids - sulfur compounds - other volatile components - types of flavor - developed flavor - processed flavor - added flavour- Texturing agents – gelatin- Sweeteners- artificial sweeteners

Unit-III (8 Hrs)

Food colors

Natural coloring matters – chlorophylls – carotenoids – anthocyanins – flavonoids – anthocyanins – tannins - quinines and xanthones- betalains

Synthetic colors - banned colors

Spoilage - Microbial spoilage - bacteria, yeast, moulds-enzymatic spoilage - spoilage by insects, parasites and rodents - characteristics and storage conditions of food.

Unit-IV (8 Hrs)

Principles and methods of preservation – Asepsis - preservation by high temperature – pasteurization – sterilization - Aseptic canning – preservation by low temperature - chemicals, sulphur dioxide, benzoic acid – drying – filtration – carbonation – sugar –fermentation – salt – acids - oils and spices – antibiotics - irradiation.

Canning and bottling of fruits and vegetables - principles and process of canning - different methods - canning of fruits - canning and bottling of vegetables - canning of curried vegetables - specific requirements for canning of fruits and tomatoes.

Unit-V (8 Hrs)

Fruits and vegetables drying/dehydration-techniques-advantages of dehydration over sun drying

Freezing of fruits and vegetables - methods of freezing - sharp freezing - quick freezing - cryogenic freezing - dehydro-freeze drying

Quality control in food processing industry

F.P.O specification - storage life - permissible limits of preservatives – classification and their ill effects of food toxins.

References:

1. R. P. Srivatsava, Sanjeev Kumar, Fruits and vegetable preservation, International book distributing company, 2006.
2. L. H. Meyer, Food Chemistry, CBS Publications & Distributors, 2004.
3. H.K.Chopra, P.S.Panesar, Food Chemistry, Narosa Publishing House Pvt Ltd, 2010.

Mapping of Bloom's Taxonomy with Course Outcome					
Bloom's Taxonomy	**Unit-I**	**Unit-II**	**Unit-III**	**Unit-IV**	**Unit-V**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
K1-Remembering	**X**	**X**	**X**	**X**	**X**
K2-Understanding	**X**	**X**	**X**	**X**	**X**
K3-Applying		**X**			**X**
K4-Analyzing					
K5-Evaluating					
K6-Creating					