Sacred Heart College (Autonomous), Thevara

Department of Chemistry

BSc Chemistry

Semester 6

2018 - 19

COURSE STRUCTURE

COURSE CODE	TITLE OF THE COURSE	NO. HRS./ WEEK	CREDITS	TOTAL HRS./SEM
15U6CRCHE09	INORGANIC CHEMISTRY II	3	3	54
15U6CRCHE10	ORGANIC CHEMISTRY IV	4	3	54
15U6CRCHE11	PHYSICAL CHEMISTRY III	3	3	54
15U6CRCHE12	PHYSICAL CHEMISTRY IV	3	3	54
15U6ELCHE1	ADVANCES IN CHEMISTRY	4	3	72

PROGRAMME	BACHELOR OF CHEMISTRY	SEMESTER	6
COURSE CODE AND TITLE	15U6CRCHE09 - Inorganic Chemistry - II	CREDIT	3
HOURS/WEEK	3	HOURS/SEM	54
FACULTY NAME	*Dr. Ramakrishnan S (RKS), Dr. Midhun Dominic C D (MD), Dr. June Cyriac (JUC)*		

Course Objective
To describe the process of metallurgy.
To explain the structure and properties of organometallic compounds, metal carbonyls metal clusters and inorganic polymers.
To illustrate the fundamentals of water quality parameters.
To explain the chemistry of s and p block elements.
To discuss the structure and related properties of inorganic solids.

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
Unit – 1: Metallurgy				
1	Introduction to Metallurgy	Lecture	Quiz	
2	Methods of concentration of ore	PPT/Lecture		
3	Froth flotation and leaching	PPT/Lecture		
4	Calcination and Roasting	Lecture		
5	Reduction to free metal- smelting and electrometallurgy, hydrometallurgy	Lecture		
6	Goldschmidt Thermite Process	Lecture	Video	
7	Refining of metals- electrolytic, ion exchange, zone refining, vapour phase refining and oxidative refining	Lecture		
8	Thermodynamics of the oxidation of metals to metal oxides - Ellingham diagrams	Lecture		
9	Extractive metallurgy of U, Ti ,Th and Ni	Lecture		
Unit - 2: Metal Carbonyls and Metal clusters				
10	Preparation and properties of mononuclear carbonyls	Lecture		
11	Structures of $Mo(CO)_6$, $Fe(CO)_5$ and $Ni(CO)_4$	PPT/Lecture		
12	Polynuclear carbonyls, bridged carbonyls and bonding in carbonyls	Lecture		
13	Metal clusters – carbonyl clusters, low	PPT/Lecture		

	nuclearity carbonyl clusters and high nuclearity carbonyl clusters			
14	Metal clusters – halide clusters	Lecture		
15	Electron counting schemes for $Rh_6(CO)_{16}$ and $[Os_6(CO)_{18}]^{2-}$	PPT/Lecture		
16	Metal only clusters (Zintl ions)	Lecture		
17	Quadruple bond – structure of $Re_2Cl_8^{2-}$	Lecture		
18	Structures of various metal clusters	Lecture		
Unit - 3: Inorganic Polymers				
19	Inorganic polymers – general properties, comparison with organic polymers	Lecture		
20	Sulphur based polymers – polymeric sulphur nitride and chalcogenic glasses	Lecture		
21	Phosphorus based polymers - polyphosphazenes	Lecture		
22	Phosphorus based polymers - polyphosphates	Lecture		
23	Silicon based polymers – silicones	Lecture		
24	Silicon based polymers – silicone rubber	Lecture		
	CIA-1			
Unit - 4: Non aqueous solvents				
25	Classification of solvents, characteristics of solvents	Lecture		
26	Reactions in liquid ammonia	Lecture		
27	Alkali metal solution in liquid ammonia, their important properties.	Lecture		
28	Liquid sulphur dioxide and liquid HF	Lecture		
Unit - 5: Compounds of s and p block Elements				
29	Macrocyclic ligands:- crown ethers and cryptands	PPT/Lecture		
30	Macrocyclic effect	PPT/Lecture		
31	Alkali metal complexes with crown ethers and cryptands, their applications.	Lecture		
32	Boron hydrides – diborane, B5H9, B4H10	Lecture		
33	Closo carboranes, boron nitride	Lecture		
34	Borazine, boric acid. Peroxy acids of sulphur	PPT/Lecture		
35	Oxides and oxy acids of halogens (structure only),	PPT/Lecture		
36	Superacids, interhalogen compounds	Lecture		
37	Pseudohalogens, electropositive iodine, fluorocarbons	Lecture		
38	Fluorides, oxides and oxy fluorides of xenon	Lecture	Quiz	
Unit - 6: Structure of Inorganic Solids				
39	Close packing of spheres, ccp and hcp arrangements	PPT/Lecture		
40	Interstitial sites in close packing, Tetrahedral,	PPT/Lecture		

	Octahedral sites			
41	Radius ratio, Limiting radius ratio for trigonal, tetrahedral and octahedral sites	Lecture		
42	Use of limiting radius ratio in the structural determination of ionic crystals	Lecture		
43	Structure of ionic crystals of NaCl, CsCl, ZnS	Lecture		
44	Defects in crystals	Lecture		
45	Consequences of defects. extrinsic and intrinsic defects	Lecture		
46	Impurity defects. semiconductors, n-type, p-type	Lecture		
47	Superconductivity – an introduction	Lecture		
	CIA - II			
Unit - 7: Water quality parameters				
48	Standards for drinking water	Lecture		
49	Determination of turbidity	Lecture		
50	Determination of pH-determination of total dissolved solids	Lecture		
51	Determination of total hardness-total alkalinity-acidity	Lecture		
52	Determination of dissolved oxygen (DO), BOD	Lecture		
53	Determination of COD	Lecture		
54	Estimation of coliform count	Lecture		

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual – Written – Graded)
1	14/1/2019	Structure and bonding in boron compounds

GROUP ACTIVITES – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Group – Presentation – Non-graded)
1	15/2/2019	Water sample analysis

References

1. B.K Sharma Environmental Chemistry, 12th Edn., Goel Publishing House,2011.
2. B. R. Puri, L. R. Sharma, K C Kalia, Principles of Inorganic Chemistry, 31st Edn.Milestone Publishers, New Delhi, 2010.
3. A.K Dee, Environmental Chemistry, 3rd Edn., New Age International Pvt. Ltd.,1996.
4. Sodhi. G.S., Concepts of Environmental Chemistry, Narsa Publication House, 2009.
5. Sindhu. P. S., Environmental Chemistry, New Age International Pvt. Ltd., 2011.

6. Balaram Pani, Environment Chemistry, I. K. International Publishing House Ltd.,2007.
7. Thomas G Spiro, Chemistry of Environment, Prentice Hall of India., 2006.
8. Raghavan Nambiar., Environmental Studies, Scitech Publications (India) Pvt. Ltd.,2008.

PROGRAMME	BACHELOR OF CHEMISTRY	SEMESTER	6
COURSE CODE AND TITLE	15U6CRCHE10 : ORGANIC CHEMISTRY - IV	CREDIT	3
HOURS/WEEK	4	HOURS/SEM	54
FACULTY NAME	Dr. Joseph T Moolayil, Dr. V. S Sebastian, Dr. Franklin J, Dr. Grace Thomas		

COURSE OBJECTIVES
To understand the source, structure and functions of natural products erpenoids, alkaloids, vitamins and lipids.
To know the structure and chemical properties of carbohydrates, amino acids, proteins, enzymes and steroids.
To understand the chemical properties and syntheses of heterocyclic compounds.

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
MODULE I				
1	Natural Products - Terpenoids - isoprene rule.	PPT	video	
2	Structure elucidation of citral and geraniol.	PPT/Lecture		
3	Alkaloids - general methods of isolation	PPT/Lecture		
4	Classification – structure elucidation and synthesis of conine,	PPT/Lecture		
5	Structure elucidation- piperine	PPT/Lecture		
6	Structure elucidation- nicotine.	PPT/Lecture		
7	Vitamins – classification- structure (elementary idea) of vitamin A, C	Lecture		
8	Vitamins – classification- structure (elementary idea) of vitamin B_1, B_2, B_6	Lecture		
9	Lipids – biological functions – oils and fats – common fatty acids	Lecture		
10	Extraction and refining- hydrogenation – rancidity- identification of oils and fats	PPT/Lecture		

11	Saponification value, acid value, iodine value and RM value.	PPT/Lecture		
12	Revision			
MODULE II				
13	Classification of carbohydrates			
14	Constitution of glucose	PPT/Lecture		
15	Constitution of fructose.	Lecture		
16	Reactions of glucose and fructose - osazone formation	Lecture		
17	Mutarotation and its mechanism. Epimerisation.	Lecture	Video	
18	Configuration of monosaccharides			
19	Cyclic structure. Pyranose and furanose forms	Lecture		
20	Determination of ring size.	PPT/Lecture		
21	Haworth projection formula.	PPT/Lecture		
22	Chain lengthening and chain shortening of aldoses.	PPT/Lecture		
23	Inter conversion of aldoses and ketoses, Disaccharides	PPT/Lecture		
24	Reactions and structure of sucrose and maltose. Ring structure	Lecture		
25	Structure and properties of starch and cellulose. (elementary idea). Industrial applications of cellulose.	Lecture		
26	Revision			
CIA I				
MODULE III				
27	Aromaticity of heterocyclic compounds.	Lecture	Video	
28	Preparation, properties and uses of furan	PPT/Lecture		
29	Preparation, properties and uses of pyrrole and thiophene.	PPT/Lecture		
30	Synthesis and reactions of pyridine	PPT/Lecture		
31	Synthesis and reactions of piperidine	PPT/Lecture		
32	Comparative study of basicity of pyrrole, pyridine and piperidine with amines.	PPT/Lecture		
33	Synthesis and reactions of quinoline, isoquinoline and indole with special reference to Skraup, Bischler, Napieralskii and Fisher	PPT/Lecture		

	indole synthesis			
34	Continued.	PPT/Lecture		
35	Continued	Lecture	Quiz	
36	Revision		Q &Ans Session	
MODULE IV				
37	Amino acids- classification, Zwitter ion	PPT/Lecture		
38	Peptide- solution phase peptide synthesis.	PPT/Lecture		
39	Classification of proteins based on physical and chemical properties	PPT/Lecture		
40	Classification of proteins based on physiological functions.	Lecture		
41	Primary secondary tertiary and quaternary structure of proteins	PPT/Lecture		
42	Helical and sheet structures	PPT/Lecture		
43	Denaturation of proteins.	PPT/Lecture		
44	Nucleic acids. Types of nucleic acids - RNA and DNA	PPT/Lecture	Video	
45	Polynucleotide chain components - biological functions.	PPT/Lecture		
46	Supramolecular interactions – Significance in nucleic acids and proteins.	PPT/Lecture		
47	Green Fluorescent Proteins	PPT/Lecture		
48	Revision			
MODULE V				
49	Nomenclature and classification of enzymes	PPT/Lecture	Video	
50	Chemical nature of enzymes	PPT/Lecture		
51	Mechanism of enzyme action. Substrate specificity of enzymes. Enzyme inhibition. .	PPT/Lecture		
MODULE VI				
52	Introduction – Diels hydrocarbon			
53	Structure and functions of cholesterol	Lecture		
54	Elementary idea of HDL, LDL, Vitamin D.	PPT/Lecture		
CIA II				

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	8/1/2019	Interpretation of Primary secondary tertiary and quaternary structure of proteins

GROUP ASSIGNMENTS/ACTIVITES – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	24/2/2019	Interpretation of different Supramolecular interactions

References

1. L. Finar, Organic Chemistry - Volume I & II - Pearson Education(Chapters 8,14,17)
2. M. K. Jain and S. C. Sharma 'Modern Organic Chemistry', 3rd Edition, Vishal Publishing Company Co. (Chapter-42,43,40,38)
3. K. S. Tewari and N. K. Vishnoi, 'Organic Chemistry', 3rd Edition, Vikas Publishing House (Chapter-40,41)
4. R. T. Morrison and R.N. Boyd, 'Organic Chemistry', 6th Edition - Prentice Hall of India (Chapter-33)
5. en.wikipedia.org/wiki/Green_fluorescent_protein
6. www.scholarpedia.org/article/fluorescent_protein
7. www.conncoll.edu/ccacad/zimmer/GFP-ww/timeline.html
8. www.gonda.ucla.edu/bri_core/gfp.htm

PROGRAMME	B.Sc. CHEMISTRY	**SEMESTER**	6
COURSE CODE AND TITLE	15U6CRCHE11: PHYSICAL CHEMISTRY-III	**CREDIT**	3
HOURS/WEEK	3	**HOURS/SEM**	54
FACULTY NAME	DR. K B JOSE, Dr. IGNATIOUS ABRAHAM		

Course Objectives
To explain the basics of thermodynamics.
To explain the laws of thermodynamics and properties of thermodynamic functions.
To apply the laws of thermodynamics to various physical and chemical processes.
To describe the phase equilibria of one- and two-component systems.
To discuss the fundamentals of chemical kinetics.
To demonstrate the kinetics of various chemical reactions.

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
MODULE I				
1	Introduction to Thermodynamics	Lecture		
2	Definition of thermodynamic terms	PPT/Lecture	e-resource	
3	intensive and extensive properties	PPT/Lecture		
4	path and state functions	PPT/Lecture	e-resource	
5	exact and inexact differentials	PPT/Lecture		
6	reversible and irreversible processes	PPT/Lecture		
7	spontaneous and non-spontaneous processes	Lecture		
8	internal energy, work and heat	Lecture		
9	zeroth law of thermodynamics	Lecture		
10	First law of thermodynamics	Lecture		
11	Statement and mathematical expression	PPT/Lecture		
12	enthalpy, heat capacity	PPT/Lecture		
13	Cp and Cv relation in ideal gas systems	Lecture	video	
14	change in thermodynamic properties of an ideal gas during (i) isothermal/adiabatic, reversible/irreversible processes	Lecture		

15	Joule-Thomson experiment	Lecture		
16	Joule-Thomson coefficient $\mu_{JT,}$ inversion temperature	PPT/Lecture		
17	Thermo chemistry	PPT/Lecture		
18	Enthalpies of formation, combustion, neutralization, solution and hydration	Lecture	e-resource	
19	relation between heats of reactions at constant volume and constant pressure	Lecture		
20	Variation of heats of reaction with temperature – Kirchoff's equation	Lecture		
21	Hess's law and its application	Lecture		
22	Second law of Thermodynamics, Limitations of first law – statements of second law	PPT/Lecture	e-resource	
23	Carnot's cycle – efficiency of heat engines	PPT/Lecture		
24	Carnot theorem	Lecture		
25	Entropy – entropy change for various reversible/irreversible processes,	PPT/Lecture	e-resource	
26	Change in entropy of an ideal gas with pressure, volume and temperature	PPT/Lecture		
27	Third law of thermodynamics-statement and significance.	Lecture		
28	Free Energy Functions	Lecture		
29	Helmholtz energy and Gibbs energy – variation of Gibbs energy with T and P	Lecture		
30	Criteria for reversible and irreversible processes, Gibbs-Helmholtz equation	PPT/Lecture		
31	Clausius - Clapeyron equation, applications	PPT/Lecture	e-resource	
32	Partial molar properties – chemical potential	Lecture		
33	Gibbs-Duhem equation,	Lecture		
34	Chemical potential in a system of ideal gases,	Lecture		
35	Concept of activity.	Lecture		
36	Chemical equilibrium: conditions for chemical equilibrium	Lecture		
37	relation between Kc and Kx – Kp	Lecture		
38	Van't Hoff reaction isotherm	Lecture		
39	Temperature dependence of Kp – van't Hoff equation	Lecture		
MODULE II				
40	The phase rule, equilibrium between	PPT/Lecture		

	phases – conditions			
41	One component system – water system, sulphur system	PPT/Lecture		
42	Two component systems – solid-liquid equilibrium – simple eutectic	PPT/Lecture		
43	lead- silver system	Lecture	e-resource	
44	formation of compounds with congruent melting point ferric chloride- water system	Lecture		
45	formation of compounds with incongruent melting point sodium sulphate- water system	PPT/Lecture		
MODULE III				
45	Rate of reaction, rate equation, order and molecularity of reactions	Lecture		
46	Integrated rate expressions for first and second order reactions	Lecture		
47	Zero order reactions, pseudo-order reactions, half life	Lecture		
48	Theories of chemical kinetics: effect of temperature on the rate of reaction.	PPT/Lecture		
49	Arrhenius equation, concept of activation energy Collision theory, transition state theory	PPT/Lecture	e-resource	
50	Thermodynamic parameters for activation – Eyring equation (no derivation needed)	PPT/Lecture		
51	enthalpy and entropy of activation, Theory of unimolecular reactions – Lindemann theory.	PPT/Lecture		
52	Chain reactions – steady state treatment, hydrogen bromine reaction.	PPT/Lecture		
53	Homogeneous catalysis, enzyme catalysis – Michaelis-Menten equation (no derivation needed).	PPT/Lecture		
54	Heterogeneous catalysis – surface catalysis, uni and bi molecular reactions on surface. Elementary idea about autocatalysis	PPT/Lecture		

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	10/02/2019	Numerical Problems – First and Second laws of thermodynamics
2	05/01/2019	Numerical problems in chemical equilibrium
3	20/12/2018	Numerical problems – Chemical kinetics

PROGRAMME	BACHELOR OF CHEMISTRY	SEMESTER	6
COURSE CODE AND TITLE	**15U6CRCHE12 PHYSICAL CHEMISTRY IV**	CREDIT	3
HOURS/WEEK	3	HOURS/SEM	54
FACULTY NAME	*Dr. Thommachan Xavier, Dr Jinu George (JG), Dr Ammu Rosin (ARJ)*		

Course Objectives
To Understand concept of acids, bases and pH of solutions.
To explain the magnetic and spectroscopic properties of systems.
To understand the theory of electrical conductance and its applications.
To explain electromotive force, different electrochemical cells and its applications.

SESSION	**TOPIC**	**LEARNING RESOURCES**	**VALUE ADDITIONS**	**REMARKS**
MODULE I				
1	Introduction-concepts of acids and bases	PPT	video	
2	relative strength of acid-base pairs, influence of solvents	PPT/Lecture		
3	Classification of acids and bases as hard and soft acids and bases. Pearson's HSAB concept, applications,.	PPT/Lecture		
4	Dissociation constants – acids, bases, and polyprotic acids.	PPT/Lecture	e-resource	
5	Ostwald's dilution law. Ionic product of water – pH.	PPT/Lecture		
6	Buffer solutions – mechanism of buffer action,	PPT/Lecture		

7	Henderson equation. Hydrolysis of salts – hydrolysis constant, degree of hydrolysis, pH of salt solutions.(contd derivation)	Lecture		
8	Acid-base indicators, theories, determination of pH by indicators, solubility product principle – applications.	Lecture		
9	Introduction, optical activity	Lecture		
10	molar refraction, dielectric constant	Lecture		
11	Dipole moment, magnetic properties of molecules,	PPT/Lecture		
12	Nuclear paramagnetism,	PPT/Lecture		
13	Introduction-concepts of acids and bases	PPT/Lecture		
14	Revision			
MODULE II				
15	NMR spectrometery	PPT/Lecture		
16	The chemical shift,	Lecture		
17	Electron spin resonance (ESR)	Lecture		
18	Numericals	Lecture		
19	Introduction - Faraday's laws of electrolysis	Lecture		
20	electrochemical equivalent, and chemical equivalent	PPT/Lecture		
21	Electrolytic conductivity, molar conductivity - Variation of molar conductivity with concentration.	PPT/Lecture		
22	Kohlrausch's law – applications.	PPT/Lecture		
23	Ionic mobility – relation with ion conductivity, influence of temperature on ion conductivity,	PPT/Lecture		
24	ion conductivity and viscosity – Walden's rule	Lecture		
25	Influence of dielectric constant of solvent on ion conductivity. Abnormal ion conductivity of hydrogen and hydroxyl ions.	Lecture		
26	CIA-1			
27	Discharge of ions during electrolysis – Hittorf's theoretical device.	Lecture		
28	Transport Numbers – determination by Hittorf's method and moving boundary method.	Lecture		
29	Debye-Hückel theory of strong electrolytes	PPT/Lecture		
30	The concept of ionic atmosphere, Asymmetry and electrophoretic effect.	PPT/Lecture		
31	Debye- Hückel-Onsager equation (*no derivation*)	PPT/Lecture		
32	revision			
MODULE III				
33	Activity, mean ionic activity and mean ionic	PPT/Lecture		

	activity coefficients of electrolytes.			
34	Ionic strength of a solution, Debye-Hückel limiting law (*no derivation*)	PPT/Lecture		
35	Applications of conductance measurements	PPT/Lecture		
36	Determinations of degree of dissociation of weak electrolytes, ionic product of water	Lecture	Quiz	
37	Solubility of sparingly soluble salts.	Lecture	Q &Ans Session	
38	conductometric titrations.	PPT/Lecture		
39	Introduction - Galvanic cells, Characteristics of reversible cells	PPT/Lecture		
40	Reversible electrodes – different types, electrode potential – electrochemical series.	PPT/Lecture		
41	Reference electrodes – Standard Hydrogen Electrode, Calomel electrode, electrode potential – electrochemical series.	PPT/Lecture		
	II CIA			
42	Representation of cells – e.m.f of cell, electrode reactions and cell reactions.	Lecture		
43	Thermodynamics of reversible cells and reversible electrodes – Determination of ΔG, ΔH and ΔS of cell reaction.	PPT/Lecture		
44	E.M.F and equilibrium constant of cell reaction	PPT/Lecture		
45	Effect of electrolyte concentration on electrode potential and e.m.f - Derivation of Nernst equation.	PPT/Lecture		
46	Concentration cells – electrode concentration cell and electrolyte concentration cells	PPT/Lecture		
47	Types of electrolyte concentration cells – with transference and without transference	PPT/Lecture		
48	Liquid junction potential. Fuel cells – the hydrogen-oxygen fuel cell.	PPT/Lecture		
49	Applications of e.m.f measurements – determination of solubility product	PPT/Lecture		
50	determination of pH using hydrogen electrode	PPT/Lecture		
51	quinhydrone electrode and glass electrode	PPT/Lecture		
52	Potentiometric titrations - oxidation reduction indicators.	PPT/Lecture	Video	
53	Irreversible electrode processes – overvoltage.	PPT/Lecture		
54	Corrosion and prevention	PPT/Lecture		
55	Revision			

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	I INT	Electrochemistry in daily life
2	II INT	pH of soil and agriculture

GROUP ASSIGNMENTS/ACTIVITES – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	I INT	Corrosion in industry (Group Discussion)

References

1. K. L. Kapoor, '*A Textbook of Physical Chemistry*', Volumes 1, Macmillan India Ltd.
2. B. R. Puri, L. R. Sharma, M. S. Pathania, '*Elements of Physical Chemistry*', Vishal Pub. Co. Jalandhar.
3. I. N. Levine, *Physical Chemistry*, Tata Mc Graw Hill.
4. K. J. Laidler and J. M. Meiser, *'Physical Chemistry',* 3rd Edition, Houghton Mifflin Comp., New York, International Edition (1999).
5. Barrow, G.M. *Physical Chemistry*, Tata McGraw-Hill (2007).
6. Castellan, G.W. *Physical Chemistry*, 4th Ed. Narosa (2004).
7. Kotz, J.C., Treichel, P.M. & Townsend, J.R., *General Chemistry*, Cengage Learning India Pvt. Ltd. New Delhi (2009).
8. Mahan, B.H. *University Chemistry*, 3rd Ed. Narosa (1998).
9. Glasstone S, *An Introduction to Electrochemistry*, East-West Press (Pvt.) Ltd. (2006).
10. Gurdeep Raj, *Advanced Physical Chemistry*, Goel publishing house.
11. F A Alberty and R J Silby, *Physical Chemistry*, John Wiley.
12. P. W. Atkins, *The elements of Physical chemistry*, 8thedn, Oxford University Press.
13. S. H. Marron and J. B. Lando, *Fundamentals of Physical Chemistry*, Macmillan Ltd.

PROGRAMME	BACHELOR OF CHEMISTRY	SEMESTER	6
COURSE CODE AND TITLE	15U6ELCHE1- Advances in Chemistry	CREDIT	4
HOURS/WEEK	4	HOURS/SEM	72
FACULTY NAME	Dr. Grace Thomas, Dr. Ramakrishnan S, Dr. Abi T G, Dr. Ammu Rosin Jose.		

COURSE OBJECTIVES
To understand the advanced topics in inorganic chemistry.
To understand the advanced topics in organic chemistry like retrosynthesis, supramolecular chemistry, green chemistry and polymers.
To understand the advanced topics in physical and computational chemistry

SESSION	**TOPIC**	**LEARNING RESOURCES**	**VALUE ADDITIONS**	**REMARKS**
1. Advanced Topics in Inorganic Chemistry				
	MODULE I			
1	Nanomaterials	Conventional Lecture		
2	Synthesis of nanomaterials – chemical precipitation	Lecture with ICT- PPTs		
3	Mechano-chemical method and micro emulsion method	Lecture with ICT- PPTs		
4	Reduction technique, chemical vapour deposition and sol-gel method (brief study)	Lecture with ICT- PPTs		
5	Properties and applications of fullerenes	Lecture with ICT- PPTs	Quiz	
6	Quantum dots	Lecture with ICT- PPTs		
7	Carbon nanotubes	Lecture with ICT- PPTs		
8	Applications of nano materials - nano composites	Lecture with ICT- PPTs		
9	Nano medicines	Lecture with ICT- PPTs	Discussion	
	MODULE II			

10	Refractory materials	Conventional Lecture - Chalk & Board		
11	Carbides, nitrides, borides	Conventional Lecture - Chalk & Board		
12	Graphite and graphite oxide	Conventional Lecture - Chalk & Board	Seminar Presentation from Students	
13	Intercalation compounds of alkali metals	ICT		
14	Carbon monofluoride	Conventional Lecture - Chalk & Board		
15	Intercalation compounds of graphite with metal Halides, glass	ICT		
16	Silicates, zeolites	Conventional Lecture - Chalk & Board		
17	Ultramarines and ceramics	Conventional Lecture - Chalk & Board	Seminar Presentation from Students	
MODULE III				
18	Thermo analytical methods	**ICT**		
19	Principle of Thermo gravimetry	Conventional Lecture - Chalk & Board		
20	TGA of calcium oxalate monohydrate and Differential thermal analysis	Conventional Lecture - Chalk & Board		
21	Differential scanning calorimetry. Applications	Conventional Lecture - Chalk & Board		
22	Colorimetry: Principle, Beer's law, Lambert's law	Conventional Lecture - Chalk & Board	Seminar	

23	Absorption coefficient, transmittance, opacity	Conventional Lecture - Chalk & Board		
24	Absorbance, optical density, molar absorption coefficient	Conventional Lecture - Chalk & Board		
25	Principle of estimation of iron, chromium and ammonia	Conventional Lecture - Chalk & Board		
2 Advanced topics in Organic Chemistry				
MODULE I				
26	Introduction to Supramolecular Chemistry	Conventional Lecture		
27	Molecular Recognition	Lecture with ICT- PPTs		
CIA I				
28	Host-guest interactions.	Lecture with ICT- PPTs		
29	Types of non-covalent interactions.	Lecture with ICT- PPTs		
30	Importance of molecular recognition in DNA	Lecture with ICT- PPTs		
31	Importance of molecular recognition in protein structure	Lecture with ICT- PPTs		
32	Introduction to Supramolecular Chemistry	Lecture with ICT- PPTs	Seminar	
MODULE II				
33	Retrosynthetic analysis and disconnection approach	Lecture with ICT- PPTs		
34	Basic principles and terminology	Lecture with ICT- PPTs		
35	Retrosynthetic analysis of simple cyclic and acyclic alkenes	Lecture with ICT- PPTs		
36	Retrosynthetic analysis of alcohols	Lecture with ICT- PPTs		
37	Retrosynthetic analysis of carbonyl compounds	Lecture with ICT- PPTs		
38	Simple problems of retro synthesis of the above compounds	Lecture with ICT- PPTs	Seminar	

MODULE III				
39	Introduction to Green Chemistry	Lecture with ICT- PPTs		
40	Need for green chemistry	Lecture with ICT- PPTs	Seminar	
41	Twelve principles of green chemistry	Lecture with ICT- PPTs		
42	Examples of Green Chemistry Processes	Lecture with ICT- PPTs		
43	Green polymer	Lecture with ICT- PPTs		
44	Polylactic acid (PLA)	Lecture with ICT- PPTs		
MODULE IV				
45	Biopolymers	Lecture with ICT- PPTs		
46	Biomaterials	Lecture with ICT- PPTs		
47	Polymers in medical field	Lecture with ICT- PPTs		
48	High temperature ploymers	Lecture with ICT- PPTs		
49	Fire-resistant polymers	Lecture with ICT- PPTs		
50	Silicones	Lecture with ICT- PPTs		
51	Conducting polymers	Lecture with ICT- PPTs		
52	Carbon fibers	Lecture with ICT- PPTs		
53	General discussion about the biopolymers	Lecture with ICT- PPTs	Seminar	
3. Advanced Topics in Physical Chemistry				
MODULE I				
54	Protein structure; Amino acids	Lecture with ICT- PPTs		
55	Primary, secondary and tertiary structure	Lecture with ICT- PPTs	Discussion	
56	Protein folding. Significance of Van der Waals force, hydrogen bond and hydrophobic interactions	Lecture with ICT- PPTs		

57	Acid-Base equilibrium:Protonation and deprotonation reactions	Lecture with ICT- PPTs		
58	Biological significance of pH; Properties of proteins with emphasis on isoelectric pH	Lecture with ICT- PPTs		
59	Henderson and Hasselbalch equation. Titration curves of amino acids & pK values	Lecture with ICT- PPTs		
60	Buffers & Stability of their pH	Lecture with ICT- PPTs		
61	Thermodynamics and Kinetics. Standard free energy change in biochemical reactions, exergonic	Lecture with ICT- PPTs		
CIA II				
62	Hydrolysis of ATP. Chemical potential. Oxidation/reduction reactions and bioenergetics	Lecture with ICT- PPTs	Seminar	
63	Enzyme catalysis. Michael Menton kinetics	Lecture with ICT- PPTs		
MODULE II				
64	Scope of Computational chemistry. Building of 3D molecular structures using computer softwares. Coordinate formats	Lecture with ICT- PPTs		
65	Z-matrix, Cartesian coordinate and PDB format. Z-matrix of simple molecules H_2O, CO_2 & NH_3	Lecture with ICT- PPTs		
66	Introduction to Common computational and visualization softwares	Lecture with ICT- PPTs	Discussion	
67	Brief introduction to Hartree Fock, ab initio, semi empirical methods	Lecture with ICT- PPTs		
68	DFT and molecular mechanics methods	Lecture with ICT- PPTs		
69	Basis sets, STO & GTO basis sets	Lecture with ICT- PPTs		
70	Potential energy surface. Local and Global minima. Single point energy calculations and Geometry optimizations	Lecture with ICT- PPTs		
71	Format of input and output files in Computational Chemistry Calculations	Lecture with ICT- PPTs		
72	Single point and Optimization Calculations in simple molecules such as molecules H_2O, CO_2 & NH_3 using suitable software package	Lecture with ICT- PPTs		

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
22/2/2019	Protein: Primary, secondary and tertiary structure

GROUP ASSIGNMENTS/ACTIVITES – Details & Guidelines

Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
3/3/2019	Synthesis of nanoparticles

References

1. V. S. Muraleedharan and A. Subramanian, *Nano science and Nanotechnology*, Ane Books Pvt. Ltd. New Delhi, 2009.
2. T. Pradeep, *Nano; The Essentials*, Mc Graw-Hill education, New Delhi, 2006.
3. H.H Willard, L.L. Merritt, J.A. Dean, F.A Settle, *Instrumental methods of Analysis*, CBS Publishers And Distributors, Delhi, 1996.
4. Helena Dodzuik, *Introduction to Supramolecular Chemistry*, Springer.
5. J. M. Lehn, *Supramolecular Chemistry*, VCH
6. Paula Yurkanis Bruice, *Organic Chemistry*, 2002, (3rd Edition).
7. S. Warren, Organic Synthesis, *The disconnection Approach*, John Wiley & Sons, 2004.
8. E. J. Corey, X-M. Cheng (1995). *The Logic of Chemical Synthesis*. New York: Wiley.
9. V. K. Ahluwalia, *Green Chemistry*, *Ane Books* India.
10. Anastas, P. T.; Warner, J. C. *Green Chemistry: Theory and Practice*, Oxford University Press: New York, 1998, p.30. By permission of Oxford University Press.
11. Albert L. Lehninger, *Principles of Biochemistry*, CBS Publishers & Distributors.
12. Narayanan, P (2000), *Essentials of Biophysics*, New Age Int. Pub. New Delhi.
13. Roy R.N. (1999), *A Text Book of Biophysics*, New Central Book Agency.
14. T Clark, *Hand book of Computational Chemistry*, Wiley, New York.
15. F. Jensen, '*Introduction to Computational Chemistry*', John Wiley.
16. Christopher J. Cramer, '*Essentials of Computational Chemistry*' John Wiley,