

2020

# Allied Chemistry

## Course Structure and Syllabus

(For the candidates admitted from the academic year 2020-2021 onwards)

# CHOICE BASED CREDIT SYSTEM (CBCS)



**THANTHAI HANS ROEVER COLLEGE(AUTONOMOUS)**

**(Nationally Re-Accredited by NAAC with B<sup>++</sup>)**

**(Affiliated to Bharathidasan University, Tiruchirappalli)**

**ELAMBALUR, PERAMBALUR – 621 220**





**THANTHAI HANS ROEVER COLLEGE (AUTONOMOUS)**  
**ELAMBALUR, PERAMBALUR – 621 220**  
**PG & RESEARCH DEPARTMENT OF CHEMISTRY**



### **VISION**

To blossom as an institution of excellence, enabling, empowering and enlightening the youth and shaping them as fully developed human beings with the capacity to unfold their full mental potentiality resulting in the attainment of the wisdom to live constructively and meaningfully.

### **MISSION**

- To provide congenial and stress- free environment and opportunities for the enhancement of knowledge and acquisition skills through the best exposure and training possible.
- To offer multifaceted and need-based academic programmes and to promote extension activities.
- To adopt technology-enabled new methods, approaches and techniques so that the teaching-learning process becomes learner-centred and learner-friendly.
- To maximize the participation of all the stakeholders in the development of the institution and the region.
- To sensitize the youth towards inclusive growth for socio-economic change, sustainable development, gender equality, eco-friendliness, etc.
- To enable the youth to experience the effects of globalization and facilitate them to grow as responsible citizens and leaders.
- To inspire them, through value-based education, to embrace the entire humanity while firmly rooted in the Indian ethos.
- To provide regular placement training and placement opportunities.
- To kindle the spirit of creativity and enhance research activities and enable them to attain international standards.

### **PROGRAMME OUTCOMES**

Undergraduate programmes

Upon completion of the programme, the undergraduate will be able to

1. Acquire knowledge, understand concepts and apply new ideas which enable them to be employable or self employed.
2. Demonstrate motivation in advancing to higher learning programmes.

3. Engage in socially responsible behaviour and have value added education.
4. Have exposure to technical proficiency, analytical capability, soft skills and life skills development.
5. Develop broad understanding in the basic concepts of Languages/ Commerce / Management studies / Physical sciences / Computing sciences / Biological sciences / Life sciences.

### **PROGRAMME SPECIFIC OUTCOMES**

1. The students will understand the existence of matter in the universe as solids, liquids, and gases which are composed of molecules, atoms and sub atomic particles.
2. Students will learn to estimate inorganic salt mixtures and organic compounds both qualitatively and quantitatively using the classical methods of analysis in practical classes.
3. Students will grasp the mechanisms of different types of reactions both organic and inorganic and will try to predict the products of unknown reactions.
4. Students will learn to synthesize the chemical compounds by maneuvering the addition of reagents under optimum reaction conditions.
5. The employment areas for the B. Sc. Chemistry graduates include pharmaceutical industries, chemical manufactures, forensic science department, plastic industries, agro industries etc. apart from these they are also recruited in the field such as oil, gas and power sectors, defence services.

**Thanthai Hans Roever College (Autonomous), Elambalur, Perambalur - 621 220**  
**B. Sc Allied Chemistry - UG Course Structure under CBCS**  
**(For the candidates admitted from the academic year 2020-2021 onwards)**

Semester	Part	CourseCode	Title of the Course	Ins. Hours/ Weeks	Credits	Exam Hours	CIA (Max)	ESE (Max)	Total (Max)
I	Allied Course-I	20UCH3AC3	Allied Chemistry-I (Physics & Bot-Zoo)	4	4	3	25	75	100
II	Allied Course-II	20UCH4AC4	Allied Chemistry-II (Physics & Bot-Zoo)	4	4	3	25	75	100
	Allied Practical- I (Physics)	20UCH4AP1	Volumetric And Organic Analysis	3	3	3	40	60	100
	Allied Practical- II (Bot & Zoo)	20UCH4AP2	Volumetric And Organic Analysis	3	3	3	40	60	100

### SEMESTER-III

Course Code: 20UCH3AC3

Exam Hours: 3

Instruction Hours: 4

Internal Marks: 25

Credits: 4

External Marks: 75

### ALLIED CHEMISTRY-I

#### INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY - I

##### Course Outcomes:

- Get knowledge about basic concepts of Periodic properties
- Students gain knowledge on Volumetric analysis.
- Preparation, properties Aliphatic Compounds
- Students can get knowledge of Thermosetting and thermoplastics
- Students can learn about the Synthetic Products.
- Gain knowledge about Basic Physical Chemistry

##### Unit – I Periodic properties

Ionization potential, electron affinity and electro negativity - variation in the periodic table ,  
Molecular Orbital Theory: Some important basic concepts of molecular orbital theory – LCAO-  
Bonding , anti-bonding orbitals and bond order – applications of MO theory to H<sub>2</sub>, He<sub>2</sub>, O<sub>2</sub> and F<sub>2</sub>  
molecules, Industrial Chemistry: Fuel gases – Water gas, Producer gas, L.P.G., Gobar gas and  
Natural gas. Fertilizers – N.P.K and mixed fertilizers. Soap and detergents– An elementary idea of  
soap and detergent.Cleansing action of soap and detergents.

##### Unit – II Volumetric analysis

Standard solution, titration, equivalence point, end point, indicators, primary and secondary  
standards, expressing concentrations of standard solutions – Normality, Molarity, Molality and  
mole fraction.Volumetric titrations – Acid base titrations – theory – strong acid Vs strong base,  
strong acid Vs weak base. Redox titrations – theory – Mohr salt Vs KMnO<sub>4</sub>, complexometric  
titrations – theory – EDTA titrations.

##### Unit – III Aliphatic Compounds

General methods of preparation of alkanes, properties- mechanism of free radical halogenation of  
alkanes, conformation analysis of ethane, n- butane and cyclohexane.Methods of preparation of

alkenes-stereochemistry of dehydrohalogenation (E1, E2, E1CB mechanism). Properties of alkenes-electrophilic and nucleophilic addition mechanisms.

#### **UNIT-IV Synthetic Products**

Synthetic Compounds– Teflon, Alkyl and Epoxy resins, Polyesters – definitions and uses Types of polymerization – Thermosetting and thermoplastics. Heterocyclic compounds: Furan, thiophene, pyrrole and pyridine – Preparation and properties. Stereoisomerism: Optical isomerism – lactic and tartaric acid – Racemic mixture and resolution – Geometrical isomerism – maleic and fumaric acid.

#### **Unit – V Physical Chemistry**

Rate of reaction, order, molecularity, first order rate law and simple problems, half life period of first order equation, pseudo first order reaction, zero and second order reactions. Arrhenius and collision theories- assumption, derivation, demerits- experimental determination of order of reactions.

#### **TEXT BOOKS**

1. I. Bahl and Arun Bahl – “Advanced Organic Chemistry” – 19th Edition., (2005) – Sulthan and Chand company, New Delhi.
2. M.K. Jain – “Organic Chemistry” – 12th Ed., (2003) Sulthan and Chand Company, New Delhi.

#### **REFERENCES:**

1. R.D. Madan, J.S. Tiwari and G.L. Mudhara – A Textbook of First Year B.Sc. Chemistry: S.Chand and Co, 2002.
2. B.R. Puri and L.R. Sharma – Principles Of Inorganic Chemistry: Shoban Lal Nagin Chand And Co., New Delhi (2000).
3. B.R. Puri, L.R. Sharma and S. Pathania – Principles Of Physical Chemistry: Shoban Lal Nagin Chand And Co., New Delhi, 2001.
4. G.R. Gopalan, P.S. Subramanian, K. Rangarajan – “Elements of Analytical Chemistry”, Sultan Chand & Sons, 1995.

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
III	20UCH3AC3	Allied Chemistry-I	5	5						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓		✓	✓	✓	✓		✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓		✓
CO4	✓	✓	✓	✓	✓		✓	✓	✓	✓
CO5	✓		✓	✓	✓		✓	✓	✓	✓
Number of Matches(✓) = 44 Relationship: High										

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

## SEMESTER-IV

Course Code: 20UCH3AC4

Instruction Hours: 4

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

## ALLIED CHEMISTRY-II

### Course Outcomes:

- Get knowledge about basic concepts of C-ordination compounds.
- Gain knowledge about Carbohydrates
- Students gain knowledge on Aromaticity, preparation, properties and reactions of Aromaticity compounds.
- Students can get knowledge of Electrochemistry.
- Students can learn about the behavior of Solvent and can Chromatography Techniques.

### Unit - I: Coordination Chemistry

Nomenclature and isomerism of coordination compounds. EAN rule, VB and Crystal field theories of octahedral, tetrahedral and square planar complexes. Chelation and its industrial applications. Magnetic studies -magnetic susceptibility, ferromagnetism and anti ferromagnetism.

### UNIT II- Carbohydrates

Classification – Glucose and fructose – Preparation and properties – Sucrose – Manufacture and properties – Starch and cellulose – Properties and uses. Amino Acids and Proteins: Amino acids – Classification, preparation and properties. Peptides (Elementary treatment) – Proteins – Classification based on physical properties and biological functions. Nucleic acid: DNA and RNA – functions (Structure not necessary).

### UNIT III- Aromaticity

Aromaticity–Conditions –Huckel’s rule - aromaticity of benzene, Substitution reactions-Nitration, halogenation, sulfonation and alkylation of benzene, Halogen containing compounds: Preparation



and uses of Dichloromethane, Chloroform, Carbon tetrachloride, DDT and BHC, Name reactions: Benzoin, Perkin, Cannizzaro, Claisen, Haloform, Carbylamine reactions – Biuret reaction.

#### **Unit IV-Electrochemistry:**

Specific and equivalent conductance – their determination – Effect of dilution on conductivities – An elementary idea about ionic theory – Ostwald's Dilution Law, Kohlrausch Law, Conductometric titrations. pH and Buffer: Importance of pH and buffers in the living systems. pH determination by colorimetric and electrometric methods. Corrosion: Types of corrosion, Prevention.

#### **Unit – V Chromatography**

Principles of column, paper and thin layer chromatography- Photochemistry: Photochemical reaction – Lambert's law – Beer's law – Absorption, Extinction Coefficient – The law of Photochemical equivalence, Quantum efficiency, Some Photochemical reactions and their quantum yield-Phase Rule: Phase, Component, Degree of freedom, Phase Rule – Definition. One component system – Water system.

#### **TEXT BOOK**

1. P. L. Soni, "Text book of Organic Chemistry", S. Chand and Company Ltd., New Delhi.
2. Morrison R.T. and Boyd R.N., Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., (1976).

#### **REFERENCE**

1. Puri B.R., Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, (23<sup>rd</sup> edition), New Delhi, Shoban Lal Nagin Chand & Co., (1993)
2. Bahl and Arun Bahl – "Advanced Organic Chemistry" – 19<sup>th</sup> Edition., (2005) – Sulthan and Chand company, New Delhi.
3. B.R. Puri, L.R. Sharma and S. Pathania – Principles of Physical Chemistry: Shoban Lal Nagin Chand and Co., New Delhi, 2001.

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
IV	20UCH3AC4	Allied Chemistry II					4	3			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓			✓	✓	✓	✓	✓	✓	
CO2	✓	✓			✓		✓	✓		✓	
CO3			✓	✓		✓		✓	✓		
CO4	✓	✓		✓	✓	✓	✓		✓	✓	
CO5	✓		✓	✓	✓		✓	✓		✓	
Number of Matches(✓) = 34      Relationship: Moderate											

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

**SEMESTER III**  
**ALLIED CHEMISTRY PRACTICAL**

Course Code: 20UCH3AP1

Instruction Hours: 3

Credits: 3

Exam Hours: 3

Internal Marks: 40

External Marks: 60

**Course Outcomes:**

- Students can learn about the Qualitative Analysis.
- Students can learn about the Aromatic and Aliphatic Compounds.
- Students can get knowledge of Compound identification techniques.
- Learn the different reaction techniques.
- Students gain knowledge about sample report.

**I. VOLUMETRIC ANALYSIS**

a) Acidimetry and Alkalimetry

i) Estimation of hydrochloric acid

ii) Estimation of sodium hydroxide

b) Permanganometry

iii) Estimation of oxalic acid using  $\text{KMnO}_4$

iv) Estimation of ferrous sulphate using  $\text{KMnO}_4$

**II. ORGANIC ANALYSIS** A study of

(i) reactions of the following organic compounds along with

(ii) tests for Aromatic/ Aliphatic, saturated/ unsaturated, solubility in common solvents, and presence of Nitrogen :

(iii) Carbohydrate

(iv) Diamide

(v) Aldehyde

(vi) Ketone

(vii) Acid

(viii) Amine

(ix) The students may be trained to perform the specific reactions like- aliphatic or aromatic, saturated or unsaturated, solubility test, nitrogen test involving (Zn / Na<sub>2</sub>CO<sub>3</sub>) fusion, and functional group present and record their observation.

**TEXT BOOK:**

Dr.N.Muruganatham, Allied Chemistry Practical, THRC/Perambalur-2019

**REFERENCE BOOK:**

1. V.Venkateswaran, R.Veerasingam, A.R. Kulandaivelu, "Basic Principles of Practical Chemistry" Sultan Chand & Sons, New Delhi, 1997.

**Scheme of valuation**

Criteria	Marks		
Record	5		
Procedur writing	10		
	Organic analysis {15}	volumetry{30}	
Aliphatic/aromatic	2	Error	Marks
Saturated/unsaturated	2		
Element test	4	< 1 %	30
Functional group	4	1-2 %	25
derivative	3	2-3 %	15
		>3 %	10

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
IV	20UCH3AP1	Allied Chemistry Practical					4	3			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓			✓	✓	✓	✓	✓	✓	
CO2	✓	✓	✓		✓		✓	✓		✓	
CO3			✓	✓		✓		✓	✓		
CO4	✓	✓		✓	✓	✓	✓		✓	✓	
CO5	✓		✓	✓	✓		✓	✓		✓	
Number of Matches(✓) = 35 Relationship: High											

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High