

**A.VEERIYA VANDAYAR MEMORIAL  
SRI PUSHPAM COLLEGE (AUTONOMOUS)**

**POONDI-613 503, THANJAVUR (DT)**



**SYLLABUS**

*B.Sc., Chemistry*

**(From 2020 - 2021 onwards)**



### **Program specific outcome**

On completion of B.Sc. Chemistry, Students will acquire knowledge about dyes, fertilizers, paints, domestic chemicals preparation, polymers etc. This knowledge will be helpful to get job in dye industry, paint industry and some production departments in pharmaceutical industry. Also the students are able to become an entrepreneur and to start small scale industry for the preparation of domestic chemicals like Phenyl, Soaps, Detergents, Computer Sambrani and in water analysis lab.

### **Program outcome**

Students are able to understand the fundamentals of chemistry covering all the principles and perspectives. Expose the diversified aspects of chemistry where the students experience a broader outlook of the subject. Students can discretely classify to give stepwise advancement of the subject knowledge right through the three years of the term.

**B.Sc., Chemistry (2020- 2021) on wards**

Sem No.	Part	Category	Course Code	Title of the course	Maximum Marks			Minimum Marks			Hours /Week	Credits
					C.I.A.	E.E.	Total	C.I.A	E.E.	Total		
I Sem	Part I	Language	20U1CHT1/H1	Tamil – I / Hindi – I	25	75	100	10	30	40	6	3
	Part II	Language	20U1CHE1	English - I	25	75	100	10	30	40	6	3
	Part III Core	Major	20U1CHC1	General Chemistry – I	25	75	100	10	30	40	7	6
			20U1CHCP1	Volumetric Analysis practical	40	60	100	16	24	40	3	3
		Allied	20U1CHMAA1/ 20U1CHZOA1	Allied Maths-I / Allied Zoology-I	25 25	75 75	100 100	10 10	30 30	40 40	5/ 5	3/ 4
	20U2CHMAA2/ 20U2CHZOAP		Allied Maths-II (N.S.) / Allied Zoology Practical (N.S.)	- -	- -	- -	- -	- -	- -	3/ 3	-	
Part IV	ESE	20U1CHES	Environmental Studies	25	75	100	10	30	40	SS	1	
II Sem	Part I	Language	20U2CHT2/H2	Tamil – II / Hindi – II	25	75	100	10	30	40	6	3
	Part II	Language	20U2CHE2	English – II	25	75	100	10	30	40	6	3
	Part III Core	Major	20U2CHC2	General Chemistry – II	25	75	100	10	30	40	6	5
			20U2CHCP2	Organic qualitative analysis and physical constants	40	60	100	16	24	40	3	3
		Allied	20U2CHMAA2/ 20U2CHZOAP	Allied Maths – II (N.S.) / Allied Zoology-Practical (N.S.)	25 40	75 60	100 100	10 16	30 24	40 40	3/ 3	4 / 2
			20U2CHMAA3 20U2CHZOA2	Allied Maths – III / Allied Zoology – II	25 25	75 75	100 100	10 10	30 30	40 40	5/ 6	3 / 4
	IV	VBE	20U2CHV	Value Based Education	25	75	100	10	30	40	SS	0
		SBE	20U2CHS1	Skill Based Education I Textile Processing	25	75	100	10	30	40	1	1

III Sem	Part I	Language	20U3CHT3/H3	Tamil – III / Hindi – III	25	75	100	10	30	40	6	3
	Part II	Language	20U3CHE3	English – III	25	75	100	10	30	40	6	3
	Part III	Major	20U3CHC3	General Chemistry - III	25	75	100	10	30	40	5	5
			20U3CHC4	Agricultural Chemistry	25	75	100	10	30	40	3	2
			20U4CHCP3	Inorganic Qualitative Analysis Practical (N.S.)	-	-	-	-	-	-	2	-
	Allied	20U3CHPHA1	Allied Physics – I	25	75	100	10	30	40	5	4	
		20U4CHPHAP	Allied Physics Practical (N.S.)	-	-	-	-	-	-	-	3	-
Part IV	GS	20U1CHGS	Gender Studies	25	75	100	10	30	40	SS	0	
	Extra credit	-	MOOC (Massive Open Online Course)	--	-	-	-	-	-	-	-	-
IV Sem	Part I	Language	20U4CHT4/H4	Tamil – IV / Hindi – IV	25	75	100	10	30	40	6	3
	Part II	Language	20U4CHE4	English – IV	25	75	100	10	30	40	6	3
	Part III Core	Major	20U4CHC5	General Chemistry – IV	25	75	100	10	30	40	6	5
			20U4CHCP3	Inorganic Qualitative analysis practical (N.S.)	40	60	100	16	24	40	3	3
		Allied	20U4CHPHA2	Allied Physics – II	25	75	100	10	30	40	5	4
			20U4CHPHAP	Allied Physics Practical (N.S)	40	60	100	16	24	40	3	2
	Part IV	SBE	20U4CHS2	Skill Based Education II Food Preservation	25	75	100	10	30	40	1	1
	Extra credit	-	MOOC (Massive Open Online Course)	-	-	-	-	-	-	-	-	-
V	Part III Core	Major	20U5CHC6	Organic Chemistry – I	25	75	100	10	30	40	5	6
			20U5CHC7	Physical Chemistry – I	25	75	100	10	30	40	5	6



## Abbreviations

ESE: Environmental studies	SSD: Soft Skill Development
VBE: Value Based Education	GK : General Knowledge
SBE: Skill Based Elective	NME: Non – Major Elective
GS: Gender Studies	EA: Extension Activities
ME: Major Elective	SS: Self Study
CC: Certificate Course	
MOOC-Massive open online course	

<b>Parts</b>	<b>Total No. of course</b>	<b>Total Marks</b>	<b>Total Credits</b>
<b>Part – I</b>	<b>04</b>	<b>400</b>	<b>12</b>
<b>Part – II</b>	<b>04</b>	<b>400</b>	<b>12</b>
<b>Part – III</b>		<b>2600</b>	
Core Major	16		76
Core Allied	06		20
Major Elective	04		14
	.....		.....
	<b>26</b>		<b>110</b>
	.....		.....
<b>Part – IV</b>			
E.S	01	100	01
VBE	01	100	00
SBE	02	200	02
SSD	01	100	00
NME	01	100	01
G.S	01	100	00
G.K	01	100	00
Comp Test	01	100	01
	.....	.....	.....
	<b>09</b>	<b>900</b>	<b>05</b>
	.....	.....	.....
<b>Part – V</b>			
<b>EA</b>			<b>01</b>
	<b>43</b>	<b>4300</b>	<b>140</b>

**MOOC:** Massive open online course is introduced in the third and fourth semester as an extra credit course from this academic year 2020-2021. Students can avail any one or more of the courses available in MOOC to equip their skill and knowledge themselves

Field Visit / Industrial Visit / Hands on training programme having minimum 15 hours of contact time as Extra Credit course is introduced for II year UG students to gain experiential learning

Evaluation of the visit report will be held at the end of IV Semester.

Components of Evaluation

Internal Marks	40
External marks	60
Total	100

Project is introduced for III year students to cater for the needs of advanced learners as extra credit course

Components of Evaluation

Internal Marks	40
External marks	60
Total	100

Soft skill development course prescribed in V semester is changed as Life Skill Development.

This course will be handled by both Internal Staff and External Experts.

Mode of Assessment for this course is oral examination.

Components of Evaluation

Internal Marks	40
External marks	60
Total	100

#### **Skill Based Elective Offered by the Chemistry Department**

1. Textile Processing
2. Food Preservation

#### **Certificate Course Offered by the Chemistry Department:**

Food Processing & Quality control will be conducted for III UG students as an Extra Credit Course  
MOOC online course - Extra Credit Course

#### **Non – Major Elective paper offered by the Chemistry Department**

Chemical aspects in Agriculture

**A.VEERIYA VANDAYAR MEMORIAL SRI PUSHPAM COLLEGE (AUTONOMOUS),  
POONDI, THANJAVUR DIST.**

**Question Pattern for UG and PG Programmes for students to be admitted  
during 2020 – 2021 and afterwards**

**Total Marks: 75**

**QUESTION PATTERN**

**SECTION – A  
(Question 1 to 10)**

**10 x 2 = 20 Marks**

1. Short Answer Questions
2. Two Questions from each units (All are answerable)

**SECTION – B  
(Question 11 to 15)**

**5 x 5 = 25 Marks**

1. 5 Paragraph type questions with "either / or" type choice.
2. One question from each unit of the Syllabus.
3. Answer all the questions.

**SECTION – C  
(Question 16 to 20)**

**3 x 10 = 30 Marks**

1. 5 Essay type questions – any three are answerable.
2. One questions from each unit of the Syllabus.



Semester	Subject Code	Title Of The Paper	Hours Of Teaching / Week	No. of Credits
I	20U1CHT1	<b>இக்கால இலக்கியம்</b> (செய்யுள் , உரைநடை, சிறுகதை, புதினம், நாடகம் இலக்கிய வரலாறு )	6	3

### நோக்கம்

1. இக்கால இலக்கிய வகைகளைக் கண்டறிவர்
- 2.எழுத்து,சொல் இலக்கணங்களின் அடிப்படைகளைக் கண்டறிவர்.
- 3.புதுக்கவிதை வாயிலாக வெளிப்படும் சமூக,அரசியல்விழுமியங்களை மதிப்பிடுவர்.
4. இக்கால இலக்கியத்தின் மீதான விருப்பத்தை மிகுவித்தல்.

### கூறு: 1 செய்யுள்

நேரம்:18

1. பாரதியார் : கண்ணன் என் காதலன்,கண்ணம்மா என் காதலி (முதல்பாடல் மட்டும்)
2. பாரதிதாசன் : தமிழின் இனிமை,தமிழ் உணர்வு
3. கவிமணி : ஒற்றுமையே ,உயர்நிலை-நாட்டுக்குழைப்போம்
4. சுரதா : சிக்கனம்

### கூறு: 2 செய்யுள்

நேரம்:18

1. பட்டுக்கோட்டை கல்யாணசுந்தரம்:நாட்டுக்கொரு வீரன்
2. கண்ணதாசன் : காலக்கணிதம்
3. மு.மேத்தா: கண்ணீர் பூக்கள் ,ஊர்வலம்,தாய் ,வெளிச்சம் வெளியே இல்லை
4. அப்துல் ரகுமான் : தேவகானம் - தேர்ந்தெடுக்கப்பட்ட 5 பாடல்கள்

### கூறு: 3 சிறுகதை

நேரம்:18

1. கேட்டிவி : குரல்கொடுக்கும் வானம்பாடி (1-10 )
2. கேட்டிவி : மனோராஞ்சிதம் (1-10 )

### கூறு: 4 புதினம்

நேரம்:18

புதினம் : துணிந்தவன் - வல்லிக்கண்ணன்

### கூறு:5 நாடகம் ,இலக்கிய வரலாறு

நேரம்:18

- 1.நாடகம் : மாமன்னன் இராசராசன் - கு.வெ.பாலசுப்பிரமணியன்
- 2.இலக்கிய வரலாறு : இருபதாம் நூற்றாண்டு இலக்கியங்கள்

### பயன்கள்

1. தமிழ் இலக்கியத்தின் மீதான ஆர்வம் மிகும்.
2. புதிய இலக்கிய வளங்களை அறிவர்.
3. கவிதை, சிறுகதை ஆகியவற்றைப் படைக்க முயல்வர்.
4. போட்டித் தேர்வுகளுக்குச் செல்பவர்கள் பயன் பெறுவர்.
5. நாடகக் கலைத்திறனை அறிவர்



Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I	20U1CHC1	General Chemistry – I	7	5

## Objectives

1. To introduce the salient aspect of standardized names and symbols to represent atoms, molecules, ions and apply on chemical reactions.
2. To have an idea about the behavior and interactions between matter and energy at both the atomic and molecular levels.
3. To understand the chemistry of alkanes.
4. To know about familiar with safe-handling of chemical and simple first aid procedures for accidents involving acids.

### Unit - I Atomic structure and Periodic properties:

**Atomic Structure :** Atomic number and mass number, Orbit and orbital – Shapes of atomic orbitals - principal, azimuthal, magnetic and spin quantum numbers. **Filling up of atomic orbitals:** Pauli's exclusion principle, Aufbau Principle, (n+l) rule –Hund's rule. Electronic configuration of elements - stability of half-filled and completely filled orbitals.

**Modern periodic table-** classification of elements as s-,p-,d- and f- block elements and their characteristics. **Periodic properties:** Description - - variation of atomic volume, atomic & ionic radii, ionisation potential, electron affinity, electronegativity and metallic characters along the periods and in groups -factors influencing the periodic properties. Pauling's and Mulliken's Scales of electro negativity

### Unit – II Basic quantum chemistry

Electromagnetic radiation - characteristics of wave - Black body radiation and Planck's quantum theory - photo electric effect– Compton effect - De Broglie hypothesis and de Broglie equation - Davisson and Germer experiment. Heisenberg's uncertainty principle -. Schrödinger wave equation. Physical significance of  $\Psi$ (psi) function and their significance - Nodal planes and nodal points in atomic orbitals.

### Unit – III Basic concepts in organic chemistry

Sigma and pi bonds– Concept of hybridization – Structure of organic molecules based on  $sp^3$ ,  $sp^2$  and  $sp$  hybridization. **Covalent bond properties of organic molecules:** Bond length, bond energy, bond polarity, dipole moment - inductive, electromeric, mesomeric (resonance) and hyper conjugative effects. Nomenclature- alkanes (up to 10 carbon systems) – functional groups – mono and bi-functional compounds - Structural isomerism with appropriate examples.

### Unit – IV Alkanes

**Sources of alkanes** – General methods of preparations. **Physical properties** - Octane number, Cetane number and Flash point. **Chemical properties** with mechanism of free radical substitution for halogenation. **Cycloalkanes:** Preparation and properties – ring opening reactions - conformational study of ethane ,n-butane and cyclohexane - relative stability of cycloalkanes – Bayer's Strain theory & its limitations.

**Unit – V: Lab safety and titrimetry:**

**Laboratory Hygiene and safety:** Storage and handling of corrosive, flammable, explosive, toxic, carcinogenic and poisonous chemicals - simple first aid procedures for accidents involving acids, alkalis, bromine, burns and cut by glass - threshold vapour concentration and safe limits.

**Concentration of solution:** Strength of solution, Standard solution: Molarity (M), Normality (N), normal solution, decinormal solution, centinormal solution – problems.

**Indicators:** Theory of indicators, choice of indicators. Uses of phenolphthalein and methyl orange.

**Titrimetric analysis:** General terms: volumetric analysis, titration, titrate, titrant, end point, equivalent point, indicator, Types of titration-Acid base titration, Redox titration, Complexometric titration, Precipitation titration, Non aqueous titration. Requirements for titrimetric analysis. -Primary and secondary standards, criteria for primary standards, Limitation of volumetric analysis, - Neutralisation titration curve.

**COURSE OUTCOME:**

After completion of this course students will be able to

1. acquire the knowledge on the basic idea of atomic structure and Periodic properties
2. predict the behavior and interactions between matter and energy at both the atomic and molecular levels.
3. know the chemistry of alkanes and cycloalkanes.
4. assess with safer -handling methods of chemicals and simple first aid procedures for accidents in chemical laboratory.

**Books for Reference:**

1. Puri B.R. Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, Milestone Publishers, Delhi (2008)
2. Gopalan R., Inorganic Chemistry for undergraduate students, Universities Press(India) Pvt.ltd.,Hyderabad(2009)
3. Puri B.R.,Sharma L.R., Pathania M.S., Principles of Physical Chemistry, Vishal Publishing Co., Jalandar, (2004)
6. Morrison R.T., Boyd R.N. Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., (2006).
7. Bahl B.S. Arun Bahl, Advanced Organic Chemistry, S. Chand & Company ltd., New Delhi, (2005).

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>I</b>	<b>20U1CHCP1</b>	<b>Volumetric Analysis practical</b>	<b>3</b>	<b>3</b>

### Course Outcomes

1. To develop the skill in specific area of the techniques of titrimetric analyses.
2. To familiarize the basic knowledge with safe-handling of chemical balance.

#### A. Acidimetry and alkalimetry

1. Estimation of HCl by NaOH using a standard oxalic acid solution
2. Estimation of Na<sub>2</sub>CO<sub>3</sub> by HCl using a standard Na<sub>2</sub>CO<sub>3</sub> solution

#### B. Permanganometry

3. Estimation of oxalic acid by KmnO<sub>4</sub> using a standard oxalic acid solution
4. Estimation of Iron (II) sulphate by KmnO<sub>4</sub> using a standard Mohr's salt solution.

#### C. Dichrometry

6. Estimation of KMnO<sub>4</sub> by thio using a standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution.
7. Estimation of Fe (III) by using K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> using a standard Mohr's salt solution using internal and external indicators (not for examination).
8. Estimation of copper (II) sulphate by K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution

#### D. Applied Experiments (not for examination)

9. Estimation of Total Hardness of water
10. Estimation of available Chlorine in Bleaching Powder
11. Estimation of chloride ion in neutral solution

### Reference:

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, Sultan Chand & sons, New Delhi, (1997)
2. Dr.Murugan,Former Head, Department of Chemistry , Micro scale Analysis procedure –Material (2012)

Semester	Subject Code	Title of the Paper	Hours of Teaching/ Week	No. of Credits
<b>I</b>	<b>20U1CHMAA1</b>	<b>Allied Mathematics-I</b>	<b>5</b>	<b>3</b>

**Objectives:**

- To introduce the basic concepts of summation of series, theory of equations, special types of matrices, trigonometry and calculus.

**UNIT-I**

**Algebra:** Binomial series - Application of Binomial theorem to the summation of series - Exponential series - summation of series using exponential series- Logarithmic series.

**UNIT-II**

Theory of Equations: Nature of roots - Relation between the coefficients and the roots of an algebraic equation - Transformation of equations - Reciprocal Equations.

**UNIT-III**

Matrices: Eigen values and eigen vectors - Diagonalisation - similar matrices - Cayley-Hamilton theorem - Eigen values for symmetric matrices.

**UNIT-IV**

Trigonometry: Expansion of  $\cos n\theta$ ,  $\sin n\theta$  and  $\tan n\theta$  - Powers of Sines and Cosines of  $\theta$  in terms of multiples of  $\theta$  - expansion of  $\sin\theta$  and  $\cos\theta$  in a series of ascending powers of  $\theta$  - Hyperbolic Functions - Relation between hyperbolic functions.

**UNIT-V**

**Differential Calculus:** Curvature - circle, radius and centre of curvature - Cartesian formula for radius of curvature - coordinates of centre of curvature - parametric form - Maxima and minima of a function of two variables.

**Textbook:**

**Ancillary Mathematics, Volume-I**, S. Narayanan, R. Hanumantha Rao, T.K.Manicavachagom Pillay, S. Viswanathan Printers Pvt. Ltd., 2013.

- Unit I : Chapter 1 (Pages: 7 - 17, 28 - 37, 40 - 49)
- Unit II : Chapter 2 (Pages: 59 - 83)
- Unit III : Chapter 3 (Pages: 151 - 164)
- Unit IV : Chapter 5 (Pages: 220 - 247)
- Unit V : Chapter 6 (Pages: 296 - 309, 318 - 326)

References:

1. **Allied Mathematics, Paper-I, First Semester**, P. Kandasamy and K. Thilagavathy, S.Chand & Company Pvt. Ltd., New Delhi, 2014.
2. *Algebra Volume I*, T.K.M. Pillay, T. Natarajan and K.S.Ganapathy,
3. **Calculus Volume I**, S. Narayanan and T.K. Manicavachagom Pillay,
4. *Trigonometry*, Narayanan and T.K.Manicavachagom Pillay,

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>I</b>	<b>20U1CHZOA1</b>	<b>ALLIED ZOOLOGY – I</b>	<b>5</b>	<b>4</b>

**Objectives:**

1. To acquire a basic knowledge of animal diversity and organization.
2. To study the general aspects of Invertebrates and Parasites.
3. To study the general aspects of Chordata animals and their anatomy.
4. To learn the general principles.

**Unit I**

**Hrs15**

Phylum Protozoa : Detailed study of Plasmodium - Protozoan Parasites of Man  
 Phylum Porifera: cellular structure of Leucosolinia  
 Phylum Coelenterata: Obelia – Detailed study.

**Unit II**

**Hrs15**

Phylum Platyhelminthes: *Taenia solium* - Organisation and Life history.  
 Phylum Aschelminthes: Ascaris- Organisation and Life history

**Unit III**

**Hrs15**

Phylum Annelida: Details study of Earthworm  
 Phylum Arthropoda: External characters of Prawn and life history of Prawn

**Unit IV**

**Hrs15**

Phylum Mollusca: Freshwater Mussel – external characters only.  
 Phylum Echinodermata: Detailed study of Fish star.

**Unit V**

**Hrs15**

General characters and outline classification of Phylum Chordata Rat: External characters, Digestive system, Respiratory system, Circulatory system and Urinogenital system.

**References**

1. EkambaranathaIyer, M and Anatha Krishnan, T.N – Outlines of Zoology
2. Nair, N.C., Leelavathy, L. SoundaraPandian, N., Murugan, T and Arumugam, N. 2009. A Text book of Vertebrates. Saras Publications. Nagercoil.
3. Rastogi, V.B. 1984. Invertebrate Zoology. KedarNath Ram Nath Publications, Meerut.

**Web Link:**

[https://oeb.harvard.edu/oeb-courses \(Harvard\)](https://oeb.harvard.edu/oeb-courses (Harvard)) (Biology of Invertebrates)  
<https://www.studocu.com/ph/document/notre-dame-of-dadiangas-university/vertebrate-structure-function-and-morphology/lecture-notes/bio-23-syllabus-edited-2019/5423920/view> (Notre Dame of dadiangas University)

**Outcome:**

- Learn about the classification and evolution of Invertebrates and Vertebrates
- Study on Anatomy of Invertebrates and Vertebrates.
- Develop the knowledge on Physiology of Invertebrates and Vertebrates.
- Enhance the economic importance of Invertebrates and Vertebrates.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
I & II	20U2CHMAA2	Allied Mathematics-II (NS)	3+3	--

**Objectives:**

- To introduce concepts correlation and regression.
- To introduce the concepts of interpolation, numerical solution of ordinary differential equation and multiple integrals.

**UNIT – I**

**Correlation and Regression:** Karl Pearson coefficient of correlation – Rank correlation – Regression: Regression coefficients – Properties of regression coefficients

**UNIT – II**

**Interpolation:** Gregory Newton forward interpolation formula - Backward interpolation formula- Gauss forward interpolation formula - Backward interpolation formula – Lagrange’s interpolation formula (**no proofs, simple problems only**).

**UNIT – III**

**Numerical solution of ordinary differential equation:** Taylor series – Euler’s method – Modified Euler’s method – R. K method (4<sup>th</sup> order only).

**UNIT – IV**

**Beta and Gamma Functions:** Definitions – Convergence of  $\Gamma(n)$  – Recurrence formula of gamma function – Properties of beta function – relation between beta and gamma functions - Problems.

**UNIT – V**

Multiple integral: Double integral – Evaluation of double integral - change of order of integration – Polar coordinates - Triple integrals - Application of multiple integrals.

**Text Book:**

1. **Fundamentals of Mathematical Statistics**, S.C. Gupta, V. K. Kapoor, Sulthan, 2002.  
Unit I: Chapter – 10(Sec.10.2–10.4, 10.7), Chapter – 11(Sec.11.1–11.2.2)
2. **Numerical methods**, P. Kandasamy, Thilagavathi and Gunavathi  
Unit II: Chapter: 6 (6.1-6.3), Pages: 209 – 225, Chapter: 7 (7.1-7.4), Pages: 231 – 240, Chapter: 8 (8.7 only), Pages: 271 - 276.  
Unit III: Chapter – 11(Sec.11.5, 11.9, 11.11 – 11.3), Pages:352 – 358,369 -389
3. **Calculus Vol II** : T.K. M. Pillai, 2015  
Unit IV: Chapter 7 (Sec: 2 – 5)  
Unit V : Chapter 5 (Sec: 2 – 5.3)

**General References:**

1. Statistics – M. Sivathanupillai
2. Ancillary Maths - P.R.,Vittal, Margam Publications.



Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>I &amp; II</b>	<b>20U2CHZOAPL</b>	<b>Allied Zoology Practical (NS)</b>	<b>3</b>	<b>--</b>

**Objectives:**

1. To know the Digestive system, Nervous system of Earthworm and Cockroach.
2. To dissect and study the circulatory of Calotes.

**Dissection**

Earth worm-Nervous system.

Cockroach – Digestive and Nervous system.

Freshwater Mussel – Digestive system.

Calotes - Arterial and Venous system –Virtual Lab .

**Mounting:**

Earthworm - Body setae and penial setae.

Freshwater mussel - Pedal ganglion.

Cockroach and Honey bee - Mouth parts

Shark - Placoid scales

**Spotters:**

Paramecium, Trypanosoma, Sponge gemmules, Obelia colony, Obelia medusa, Ephyra larva, Physalia, *Fasciola hepatica*, T.S. of liver fluke, micracidium larva, Redia larva, Cercaria larva, *Taenia solium* entire, Scolex, Nereis entire, T.S. of Nereis, Parapodium, Leech entire, T.S of leech, Glochium larva, Starfish entire, Bipinnaria larva. Amphioxus entire, Shark, Salamander, Calotes, Pigeon and Rat.

A record of lab work should be maintained and submitted at the time of practical examination for valuation.

**Reference**

1. Ekambaranatha Iyer, M and Ananthakrishna, T.N. Outlines of Zoology.

Semester	Subject Code	Title Of The Paper	Hours Of Teaching/ Week	No. of Credits
II	20U2CHT2	இடைக்கால இலக்கியம் - பயன்முறைத் தமிழ் -இலக்கண இலக்கிய வரலாறு,	6	3

### நோக்கம்

1. தமிழிலக்கிய வரலாற்றில் பக்தி இலக்கியங்கள் பெறும் சிறப்பை உணர்வர்.
2. சமய வழிச் சமூக மாற்றத்தின் பெறுவர்.
3. சமய நல்லிணக்க உணர்வை மாணவர்கள் பெறுவர்.

### கூறு: 1

நேரம்:18

1. திருஞானசம்பந்தர் தேவாரம் : சீகாழி திருப்பதிகம்— அடலேற அமருங்கொடி அன்ன (பா.எ.360—370)
2. திருநாவுக்கரசர் தேவாரம் : திருவையாற்றுப் பதிகம் விடகிலேன், அடிநாயேன்; வேண்டியக் கால் யாதொன்றும் (பா.எ.124—133 )
3. சுந்தரர் தேவாரம் : திருமழ்பாடி பதிகம் பொன் ஆர் மேனியனே! புலித்தோலை அரைக்கு அசைத்து,(பா.எ.1-10 பாடல்கள் ) 4. மாணிக்கவாசகர் : திருவாசகம் - பிடித்த பத்து

### கூறு: 2

நேரம்:18

1. பெரியாழ்வார் : திருமொழி - தாய்ப்பால் உண்ண அழைத்தல் 129—138 வரை 10 பாசுரங்கள்
2. குலசேகர ஆழ்வார்: பெருமாள் திருமொழி- இராமர் தாலாட்டு - 719—729 II பாசுரங்கள்
3. ஆண்டாள் நாச்சியார்: நாச்சியார் திருமொழி - திருமணக்கனவை உரைத்தல்
4. திருப்பாணாழ்வார் : அமலனாதிபிரான் - 10 பாசுரங்கள்

### கூறு: 3

நேரம்:18

1. குமரகுருபரர் : வருகைப் பருவம் - 10 பாடல்கள்
2. திரிகூடராசப்பக்கவிராயர் : குற்றாலக் குறவஞ்சி - குறத்தி மலைவளம் கூறல்
3. வீரமாமுனிவர் : தேம்பாவணி - காட்சிப்படலம் முழுவதும்
4. உற்றுப்புலவர் : சீறாப்புராணம்-விலாதத்துக் காண்டம்-கதீஜா கனவு கண்ட படலம்

### கூறு: 4 பயன்முறைத்தமிழ்

நேரம்:18

எழுத்தியல்: உயிரெழுத்து, மெய்யெழுத்து, உயிர்மெய்யெழுத்து,முதலெழுத்து, சார்பெழுத்து, மொழிக்கு முதலாகவும் இறுதியாகவும் வரும்எழுத்துக்கள்,போலி. சொல்லியல்: இலக்கண, இலக்கிய வகையிலான சொற்கள். பொதுவியல் : எழுத்துப் பிழைகளை நீக்குதல்,எழுத்துப் பிழைகளும் திருத்தங்களும்,வலி மிகுதல்,வலிமிகாமை ,வாக்கிய அமைப்புக்கள், நிறுத்தற் குறியீடுகள்.

### கூறு:5இலக்கணஇலக்கிய வரலாறு

நேரம்:18

1. இலக்கண வரலாறு (தமிழ்த்துறை வெளியீடு)
2. தமிழ் இலக்கிய வரலாறு: இடைக்கால இலக்கியம்

### பயன்கள்

1. பல்வகை சமய இலக்கியப் போக்குகளை அறிந்து கொள்வர்.
- 2.சமயவழித் தமிழரின் வாழ்வியலை அறிவர்.
3. பல்வகை சமயக் கோட்பாட்டினை அறிந்துகொள்வர்.
4. பிழையின்றி எழுதப் பழகுவர்.
5. சமயங்களின் இன்றியமையாமையை உணர்வர்

Semester	Course Code	Title of The Course	Hours of Teaching/ Week	No. of Credits
<b>II</b>	<b>20U2CHE2</b>	<b>PART – II- Extensive Readers and Communicative Skills</b>	<b>6</b>	<b>3</b>

### Objective

- **To impart language and communicative skills through short stories, one- act plays and communicative grammar.**

### Unit – I

- Shakespeare - The Seven Stages of Man
- Longfellow - A Psalm of Life
- Nissim Ezakiel - Enterprise
- William Wordsworth - The world is too much with us

### Unit – II

- Anton Chekhov - The Bear
- Cedric Mount - The Never-Never Nest
- Farrell Mitchell - The Case of the Stolen Diamonds
- M.V. Rama Sharma - The Mahatma

### Unit - III

- Fyodor Dostoyevsky - The Christmas Tree and the Wedding
- The Duchess - The Jewelry
- O. Henry - The Romance of a Busy Broker

### Unit – IV

Tense, Question Tag, Dialogue Writing, Paragraph Writing, Adjectives, Adverb

### Unit – V

Voices, Degrees of Comparison, Direct and Indirect

### Course outcomes

**After the completion of this course students will be able to**

- **promote the linguistic and communicative objectives through the study of poems, short stories and the communicative grammar.**
- **gain language and communicative skills through short stories**
- **identify and differentiate different forms of literature.**
- **engage in reflective writing after learning the prescribed lessons.**
- **enhance the communicative skills through LSRW**

### Prescribed Texts:

- *Voices of Vision*, Board of Editors, NCBH, Chennai, 2016.
- *Communicative Grammar*, The Department of English Course Material.

semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>II</b>	<b>20U2CHC2</b>	<b>General Chemistry – II</b>	<b>6</b>	<b>5</b>

### Objectives

1. To learn about properties of ionic compounds lattice energy, Born-Haber cycle and its applications.
2. To introduce the salient aspect about synthetic methodology and chemical modifications of alkenes, dienes and alkynes.
3. To understand the possible chemical modification of Aromatic compounds.
4. To have an idea about to use accepted models to describe the reactions between gaseous systems and become aware of their physical properties.

### Unit I– Chemical Bonding

**Classification of bonds:** Ionic bond - factors favoring formation of ionic bond – lattice energy - Born Haber Cycle – covalent bond – types (single, double, triple) – character of covalent bond – coordinate bond – polarization of ions - Fajan’s rule – covalent nature of ionic bond - factors affecting in the polarization of an ions - **valence bond theory** – formation of HCl, Cl<sub>2</sub> molecule – **Hybridization** – types of hybridization and shape of simple inorganic molecules - **VSEPR theory** - geometry of molecules BeCl<sub>2</sub>, BF<sub>3</sub>, NH<sub>3</sub>, H<sub>2</sub>O, PCl<sub>5</sub>, SF<sub>6</sub>, IF<sub>7</sub> and XeF<sub>6</sub> - **Molecular orbital theory** - Bonding and antibonding orbitals homonuclear and heteronuclear diatomic molecules, multicenter bonding in electron deficient molecule bond strength and bond energy. **Hydrogen bonding** - inter and intra molecular hydrogen bonding – van der Waals forces.

### Unit - II: S Block elements

**Hydrogen:** Position in the periodic table- atomic, nascent, ortho & para and occluded hydrogen –Isotopes - uses of hydrogen.

**Elements of Group IA :** General characteristics – Anomalous behaviour of Li -diagonal relationship between Li and Mg. Properties of Oxides, hydroxides and halides of alkali metals. Uses of NaOH, Na<sub>2</sub>CO<sub>3</sub>, NaHCO<sub>3</sub>, LiAlH<sub>4</sub> and NaBH<sub>4</sub>

**Elements of Group II A:** General characteristics – uses - Anomalous behaviour of Be diagonal relationship between Be and Al –Preparation, property and uses of Plaster of paris.

### Unit – III: Alkenes and Alkynes

**Alkenes:** Nomenclature – geometrical isomerism – E Z nomenclature –methods to distinguish geometrical isomers -chemical properties – Markonikov’s rule and peroxide effect - preparation and uses of polythene (using Ziegler – Natta Catalyst ) ,

**Alkadienes:** Types - thermodynamic and kinetic controlled reactions –Diels alder reaction- **Alkynes:** Nomenclature - physical properties – Acidity of acetylene, addition of H<sub>2</sub>, HX, X<sub>2</sub>, ozonolysis, hydroboration and polymerization.

#### **Unit - IV Aromatic Hydrocarbons**

Structure of benzene - resonance in benzene – delocalized cloud in benzene and its consequences – aromaticity – Huckel's rule ( $4n+2$ ) and its simple applications. **Aromatic electrophilic substitution:** Mechanisms of nitration, sulphonation, halogenations. Friedal Craft's alkylation and acylation in benzene – Orientation in benzene :activating and deactivating groups , ortho/para ratio – nuclear and side chain halogenations.

**Polynuclear hydrocarbons:** Synthesis, properties and uses of Naphthalene and Anthracene

#### **Unit – V: Gaseous state:**

Kinetic theory of gases – Kinetic gas equation– deviation from ideal behavior – compressibility factor - van der Waals equation - deviation by van der Waals – difference between ideal and real gases – **critical phenomenon** - PV isotherms of real gases, continuity of states, the isotherms of vander Waals equation, relationship between critical constant and vander Waals constant, law of corresponding states, reduced equation of state - **Molecular velocities** – distribution of molecular velocity - root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision diameter, mean free path and collision number - **Liquefaction of gases** (based on Joule Thomson effect): Linde , claud methods and demagnetisation methods.

#### **COURSE OUTCOME:**

After completion of this course students will be able to

1. explain the formation of different types of bond and describe the VSEPR and MO theory.
2. apply the nomenclature of alkenes and alkynes.
3. draw the structure of benzene and discuss its resonance properties.
4. acquire knowledge about how the molecules behave the gases state.

#### **Books for Reference:**

1. Puri B.R. Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, Milestone Publishers, Delhi (2008)
2. Soni P.L.,Mohan Katyal,Text book of Inorganic chemistry,20<sup>th</sup> edition,Sultan Chand & Son,New Delhi (1992)
3. Puri B.R.,Sharma L.R., Pathania M.S., Principles of Physical Chemistry, Vishal Publishing Co., Jalandar, (2004)
4. ArunBahl, Bahl .B.S.,Tuli G.D., Essentials of Physical , Multi colour edition,S. Chand & Company Ltd., New Delhi, (2008).
5. Morrison R.T., Boyd R.N. Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., (2006).
6. Bahl B.S. Arun Bahl, Advanced Organic Chemistry, S. Chand & Company Ltd., New Delhi, (2005).
7. Bahl B.S. Arun Bahl, Text book of Organic Chemistry, Multi colour edition,S. Chand & Coy Ltd.,New Delhi, (2006).
8. Jain M.K.,Sharma S.C., Modern Organic chemistry,Vishal Publishing Co., Jalandar, (2012)

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	20U2CHCP2	<b>Organic qualitative analysis and physical constants</b>	3	3

### Objectives

1. To strengthen the knowledge about the techniques of organic qualitative analysis.
2. To enable the learning to determination of physical constants of organic Compounds.

#### A. Organic qualitative analysis

Systematic analysis of an organic compound - Preliminary tests, detection of the element present, Aromatic or aliphatic, Saturated or unsaturated, nature of the functional group and exhibiting confirmatory tests and derivatives for the given organic compounds.

#### B. Physical constants:

Determination of physical constants (boiling point and melting point) of the given organic compound-

#### Reference:

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, Sultan Chand & sons, New Delhi, (1997)

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>I &amp; II</b>	<b>20U2CHMAA2</b>	<b>Allied Mathematics-II (NS)</b>	<b>3+3</b>	<b>4</b>

**Objectives:**

- To introduce concepts correlation and regression.
- To introduce the concepts of interpolation, numerical solution of ordinary differential equation and multiple integrals.

**UNIT – I**

**Correlation and Regression:** Karl Pearson coefficient of correlation – Rank correlation – Regression: Regression coefficients – Properties of regression coefficients

**UNIT – II**

**Interpolation:** Gregory Newton forward interpolation formula - Backward interpolation formula- Gauss forward interpolation formula - Backward interpolation formula – Lagrange’s interpolation formula (**no proofs, simple problems only**).

**UNIT – III**

**Numerical solution of ordinary differential equation:** Taylor series – Euler’s method – Modified Euler’s method – R. K method (4<sup>th</sup> order only).

**UNIT – IV**

**Beta and Gamma Functions:** Definitions – Convergence of  $\Gamma(n)$  – Recurrence formula of gamma function – Properties of beta function – relation between beta and gamma functions - Problems.

**UNIT – V**

Multiple integral: Double integral – Evaluation of double integral - change of order of integration – Polar coordinates - Triple integrals - Application of multiple integrals.

**Text Book:**

4. **Fundamentals of Mathematical Statistics**, S.C. Gupta, V. K. Kapoor, Sulthan, 2002.  
Unit I: Chapter – 10(Sec.10.2–10.4, 10.7), Chapter – 11(Sec.11.1–11.2.2)
5. **Numerical methods**, P. Kandasamy, Thilagavathi and Gunavathi  
Unit II: Chapter: 6 (6.1-6.3), Pages: 209 – 225, Chapter: 7 (7.1-7.4), Pages: 231 – 240, Chapter: 8 (8.7 only), Pages: 271 - 276.  
Unit III: Chapter – 11(Sec.11.5, 11.9, 11.11 – 11.3), Pages:352 – 358,369 -389
6. **Calculus Vol II** : T.K. M. Pillai, 2015  
Unit IV: Chapter 7 (Sec: 2 – 5)  
Unit V : Chapter 5 (Sec: 2 – 5.3)

**General References:**

1. Statistics – M. Sivathanupillai
2. Ancillary Maths - P.R.,Vittal, Margam Publications.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>I &amp; II</b>	<b>20U2CHZOAPL</b>	<b>Allied Zoology Practical (NS)</b>	<b>3</b>	<b>2</b>

**Objectives:**

3. To know the Digestive system, Nervous system of Earthworm and Cockroach.
4. To dissect and study the circulatory of Calotes.

**Dissection**

Earth worm-Nervous system.

Cockroach – Digestive and Nervous system.

Freshwater Mussel – Digestive system.

Calotes - Arterial and Venous system –Virtual Lab .

**Mounting:**

Earthworm - Body setae and penial setae.

Freshwater mussel - Pedal ganglion.

Cockroach and Honey bee - Mouth parts

Shark - Placoid scales

**Spotters:**

Paramecium, Trypanosoma, Sponge gemmules, Obelia colony, Obelia medusa, Ephyra larva, Physalia, *Fasciola hepatica*, T.S. of liver fluke, micracidium larva, Redia larva, Cercaria larva, *Taenia solium* entire, Scolex, Nereis entire, T.S. of Nereis, Parapodium, Leech entire, T.S of leech, Glochium larva, Starfish entire, Bipinnaria larva. Amphioxus entire, Shark, Salamander, Calotes, Pigeon and Rat.

A record of lab work should be maintained and submitted at the time of practical examination for valuation.

**Reference**

1. Ekambaranatha Iyer, M and Ananthakrishna, T.N. Outlines of Zoology.



Semester	Subject Code	Title of the Paper	Hours of Teaching/ Week	No. of Credits
<b>II</b>	<b>20U2CHMAA3</b>	<b>Allied Mathematics- III</b>	<b>5</b>	<b>3</b>

**Objectives:**

- To study partial differential equation
- To study vector differentiation and vector integration with application.
- To study Fourier series and Laplace transforms.

**Unit – I Partial Differential Equation:**

Derivation of partial differential equation – Different integrals of PDE – standard types of first order equations of the form  $f(p, q) = 0$ ;  $f(x, p, q) = 0$ ;  $f(y, p, q) = 0$ ;  $f(z, p, q) = 0$ ;  $f_1(x, p) = f_2(Y, q)$ ;  $z = p x + q y + f(p, q)$  – Lagrange’s method for solving  $P_p + Q_q = R$ .

---

**Unit – II Vector differentiation:**

Vector differential operator – Gradient – Direction and magnitude of gradient – Divergence and curl – Formulae involving operator  $\nabla$ .

---

**Unit –III Vector integration:**

Gauss Divergence theorem – Stoke’s theorem (no proof of the theorem).

---

**Unit – IV Laplace Transforms:**

Definition – Results and proofs: Laplace Transform of functions  $f(t) + g(t)$ ,  $cf(t)$ ,  $f'(t)$ ,  $f''(t)$ ,  $e^{at}$ ,  $\cosh at$ ,  $\sinh at$ ,  $\cos at$ ,  $\sin at$ ,  $t^n$  – some general theorems – Inverse transforms relating to the above standard forms – solution of ordinary differential equation with constant coefficients.

---

**Unit – V Fourier Series:**

Definition – finding Fourier coefficients for the given periodic function with period  $2\pi$  – Even and odd functions – Properties of odd and even functions – Half range Fourier series – Development in Cosine and sine series.

---

**Text Book:**

**Ancillary Mathematics, Volume-II**, S. Narayanan, R. Hanumantha Rao, T.K.Manicavachagom Pillay, S. Viswanathan Printers Pvt. Ltd., 2015.

- Unit I : Chapter 5, Sec: 1 – 3, 5, 6 (Pages: 252 – 257, 262 – 273)
- Unit II : Chapter 8, Sec: 16 – 21 (Pages: 335 – 357)
- Unit III : Chapter 8, Sec: 6, 9 (Pages: 381 – 389, 399 – 407)
- Unit IV : Chapter 7, Sec: 1 – 6 (Pages: 289 – 310)
- Unit V : Chapter 2, Sec: 1 – 5 (Pages: 123 – 148)

**General References:**

1. Engineering Mathematics – A Singaravelu (Volume I & II)
2. Vector Calculus – K.Viswanbathan and S.Selvaraj.
3. Ancillary Mathematics – P.R.Vittal, Margam Publications.

Semester	Subject Code	Title of the Paper	Hours of Teaching/ Week	No. of Credits
<b>II</b>	<b>20U2CHZOA2</b>	<b>ALLIED ZOOLOGY –II</b>	<b>6</b>	<b>4</b>
<b>Objectives:</b> <ol style="list-style-type: none"> <li>1. To acquire basic knowledge about the beneficial role of animals.</li> <li>2. To study the various types cultures.</li> </ol>				

**Unit-I**

**Hrs15**

**Cell biology:** Structure and functions of Eukaryotic cells - Plasma membrane – Fluid Mosaic model – Mitochondria – Molecular structure – Krebs cycle.

**Embryology:** Types of vertebrate eggs and patterns of cleavage.

**Unit-II**

**Hrs15**

**Genetics:** Mendelian Principles – Monohybrid and Dihybrid experiment with examples – Multiple alleles (ABO blood group – Rh Factor).

**Evolution:** Lamarckism and Darwinism.

**Unit- III**

**Hrs15**

**Physiology:** Physiology of digestion in man – structure and functions of human Kidney.

**Ecology:** Food chain, Food web and Energy flow.

**Unit-IV**

**Hrs15**

**Vermiculture:** Types of earthworm - Earthworm Feed Stocks- rearing technology; Types of Vermicomposting System–economic importance.

**Sericulture** –Types of silkworm; Biology and Life cycle of silkworm (*Bombyx mori*),- Role of sericulture in the farming systems - Economic importance of silkworm.

**Unit-V**

**Hrs15**

**Apiculture:** Species of Honeybee – Types of bee hive – nutritive and medicinal value of honey – Bee wax.

**Aquaculture:** Scope of Aquaculture – Freshwater cultivable fishes – Water quality management –Fish preservation – Economic importance of fishes.

## References

1. Agarwal, W.C. – Economic Zoology
2. Pradip V. Jabde – Applied Zoology.
3. T.V.R.Pillai, (1988) Aquaculture: Principles and practices. Fishing News Books.
4. Aquaculture and Fisheries Biotechnology, Genetic Approaches, 2<sup>nd</sup> Edition: Rex. A. Dunham: Department of Fisheries and Allied Applications Auburn University, Alabama USA.
5. Ethiopian Institute of Agricultural Research Livestock and Fisheries Research Strategies © EIAR, July 2017 Website: <http://www.eiar.gov.et> Tel.: +251-11-6462633 Fax: +251-11-6461294 P.O.Box 2003 Addis Ababa, Editing and design: GetnetAssefa.
6. Manual of On-Farm Vermicomposting and Vermiculture By Glenn Munroe Organic Agriculture Centre of Canada.
7. P.S.Verma and V.K.Agarwal(1996) – Cytology and Genetics.
8. Lewis Wolpert, 2011. Developmental Biology – A very short introduction, Oxford University Press Inc, New York.
9. Guy B Radley Smith, Salley Hope, Helen V. Firth and Jane A. Hurst, 2010. Oxford handbook of Genetics - Oxford University Press Inc, New York.
10. P.S.Verma and V.K.Agarwal(1996) Animal Physiology and Ecology
11. Balinsky, B.J. (1981) An introduction to embryology, CBS College Publishing.
12. Arumugam. N. Evolution, Saras Publications

## Web Link:

<http://sbs.ntu.edu.sg/prospective/undergraduate/Curriculum%20and%20Course%20Descriptions/Pages/Major-PE/Table%20A/BS2012.aspx> (NUS)  
<https://canvas.harvard.edu/courses/63060/assignments/syllabus> (Harvard University)

## Outcome:

- Gain knowledge on Culture techniques of aquatic organisms
- Learn about the Sericulture Technology
- Develop the knowledge on Apiculture Technology
- Study on Vermicomposting Technology
- Employability on Poultry farming techniques

Semester	Subject Code	Title Of The Paper	Hours Of Teaching / Week	No. of Credits
III	20U3CHT3	காப்பியங்கள், கட்டுரைகள், இலக்கிய வரலாறு	6	3

### நோக்கம்

1. காப்பியங்களின் உள்ளடக்கம், உத்திகளைக் கற்றுக்கொடுத்தல்.
2. காலந்தோறும் காப்பியங்களில் காணலாகும் பாடுபொருள்களின் மாற்றங்களை எடுத்துரைத்தல்.
3. காப்பியச்சுவையை மாணவர்கள் அறிந்து கொள்ளச் செய்தல்.

### கூறு: 1 காப்பியங்கள்

நேரம்:18

1. சிலப்பதிகாரம்: மதுரைக்காண்டம்-வழக்குரைகாதை
2. மணிமேகலை; மலர்வனம் புக்ககாதை
3. சீவக சிந்தாமணி: சுரமஞ்சரியார் இலம்பகம்
4. கம்பராமாயணம்: கங்கைப் படலம்

### கூறு: 2 காப்பியங்கள்

நேரம்:18

1. பெரியபுராணம் : மெய்ப்பொருள் நாயனார் புராணம்-முழுவதும்
2. அரிச்சந்திரபுராணம்: மயான காண்டம்
3. தேம்பாவணி: திருமணப் படலம்-1-10 பாடல்கள்
4. சீறாப்புராணம் : நபி அவதாரப் படலம்-1-10 பாடல்கள்

### கூறு: 3 கட்டுரைத் தொகுப்புகள்

நேரம்:18

1. கேட்டிவி - இராகபாவம் (1-10 )
2. கேட்டிவி - பயணங்கள் தொடரும்

### கூறு:4 கட்டுரைக் கடிதங்கள் மொழிபெயர்ப்புப் பயிற்சிகள்

நேரம்:18

- பயிற்சிக்கட்டுரைகளும் கடிதங்களும் -பாவை வெளியீடு  
கட்டுரைப் பயிற்சி - 10 மதிப்பெண்கள்  
மொழிபெயர்ப்புப் பயிற்சி - 5 மதிப்பெண்கள்

### கூறு:5 இலக்கிய வரலாறு

நேரம்:18

காப்பிய இலக்கியங்கள் - சிற்றிலக்கியங்கள்

### பயன்கள்

1. காப்பியங்கள் வாயிலாக அக்காலச் சமுதாயச் சூழலை அறிவர்.
2. பல்வேறு காப்பியங்களையும் ஒப்பிட்டு அவற்றின் தனித்தன்மைகளை அறிந்துகொள்வர்.
3. மீட்டுருவாக்கச் சிந்தனைகளை அறிவர்.
4. கட்டுரை எழுதும் திறன் பெறுவர்.
5. கடிதங்கள் எழுதும் பயிற்சி பெறுவர்.

Semester	Course Code	Title of The Course	Hours of Teaching /Week	No. of Credits
<b>III</b>	<b>20U3CHE3</b>	<b>PART - II Shakespeare, Extensive Readers And Communicative Skills</b>	<b>6</b>	<b>3</b>

#### **Objective**

- **To introduce the language and creativity of the world-renowned dramatists and novelists to enhance the communicative skills of the learners.**

#### **Unit – I**

Julius Caesar  
The Merchant of Venice

#### **Unit – II**

Macbeth  
Twelfth Night

#### **Unit – III**

Romeo and Juliet  
Tempest

#### **Unit – IV**

Thomas Hardy – The Mayor of Casterbridge

#### **Unit – V**

Note making, Hints Developing, Expansion of Ideas and Proverbs, Clauses and Sentence, Structure: Simple, Compound and Complex.

#### **Course outcomes**

##### **After the completion of this course students will be able to**

- **promote their communicative skills through the study of Shakespeare and modern communicative methods.**
- **expand their perception interacting with the culture across the world**
- **imbibe moral and ethical prescriptions**
- **appreciate the creative genius and affluent expressions of Shakespeare**
- **develop the creative and analytical faculty**

#### **Prescribed Texts:**

Natarajan, K.ed. *Selected Scenes from Shakespeare*. Chennai: NCBH, 2017.

Hardy, Thomas.*The Mayor of CasterBridge*.(abridged)Chennai: Macmillan Publishers,2012.

*Communicative Grammar*.Department of English Edition. 2017

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	20U3CHC3	General Chemistry – III	5	5

### Objectives

1. To introduce the salient aspect of the structure of boron, carbon, nitrogen, Oxygen and halogen group family elements.
2. To acquire knowledge about reducing and oxidizing nature of boron, carbon, nitrogen, oxygen, halogen and noble gas group family elements.
3. To learn about the formation of hydrides, halides and oxides, nitrogen, oxygen, halogen group family elements.
4. To impact the awareness of the fundamental aspects of Stereochemistry and its influence on chemical properties.

### Unit – I: Boron, Carbon and nitrogen family

**Group III A:** General characteristics of elements - diagonal relationship between B and Si - extraction, physical & chemical properties and uses of Aluminium – chemistry of  $Al_2O_3$ , – alloys of aluminum.

**Group IVA:** General characteristics of elements – anomalous behaviour of carbon and silicon - allotropic forms of carbon - their structures–dry ice - uses of silicon.

**Group V A:** General characteristics of elements – unique features of nitrogen–physical & chemical properties and uses of  $N_2$ .

### Unit – II: Oxygen and Halogen Family

**Oxygen Family:** Anomalous behaviour of oxygen – paramagnetic nature of oxygen - classification of oxides based on their chemical behaviour (acidic, amphoteric and neutral) and oxygen content (normal, per, super, di, sub and mixed oxides). Preparation properties and structure of peracids of sulphur.

**Oxidation and Reduction Reactions:** Definition (electronic theory) of oxidizing agents, reducing agents, equivalent weights of oxidizing and reducing agents - Oxidation number concept – Balancing redox equations by Oxidation number method and ion - electron method.

**Halogen family:** General characteristics of halogen with reference of electro negativity, electron affinity, oxidation states and oxidizing power - peculiarities of fluorine. Inter halogen compounds: Types – preparation and properties of  $ICl$ ,  $BrF_3$ ,  $ClF_5$  and  $IF_7$ . Pseudo halogens: General characteristics – basic nature of iodine.

### Unit – III:

**Organohalogen compound-** preparation and Synthetic uses of Grignard reagents.

**Aliphatic nucleophilic substitution reactions:** Mechanisms of  $SN^1$ ,  $SN^2$ , and  $SN^i$  mechanisms– effect of leaving groups, nucleophiles and structure of substrate (Reactivity of methyl, ethyl, isopropyl, t-butyl, vinyl, allyl, benzyl halides).

**Elimination reactions:** mechanism of  $E_1$  and  $E_2$  reactions – elimination versus Substitution - Hoffmann and Saytzeff elimination.

**Aromatic nucleophilic substitution reactions:** Benzyne mechanism and intermediate complex mechanism.

#### **Unit – IV: Stereochemistry**

Stereoisomerism - types -optical isomerism - chirality – idea of asymmetry and dissymmetry - sequence rules - R,S notations of simple aliphatic compounds - D, L notations– erythro, threo conventions – optical activity – resolution of racemic mixture – Conformations of cyclohexane. Walden inversion Stereochemistry of molecules with axial chirality – biphenyls, allenes and spiranes- concept of atropisomerism. **Projection formulae** - Newman projection and Sawhorse formulae, Fischers and flying wedge formulae

#### **Unit – V: Qualitative Inorganic Analysis**

Dry test, flame test - Wet tests for acid radicals – Interfering acid radicals- Theory of Interference- Elimination of Interfering acid radicals.

**Principles of group separation:** Solubility Product – common ion effect

**Reactions involved in the confirmatory tests:** One confirmatory test for each of the following radicals - Sulphate, nitrate, carbonate, chloride, fluoride borate, phosphates anions and  $\text{Pb}^{+2}$ ,  $\text{Cu}^{+2}$ ,  $\text{Cd}^{+2}$ ,  $\text{Bi}^{+2}$ ,  $\text{Fe}^{+2}$ ,  $\text{Fe}^{+3}$ ,  $\text{Al}^{+3}$ ,  $\text{Cr}^{+3}$ ,  $\text{Co}^{+2}$ ,  $\text{Ba}^{+2}$ ,  $\text{Ca}^{+2}$ ,  $\text{Sr}^{+2}$ ,  $\text{Mn}^{+2}$ ,  $\text{Ni}^{+2}$ ,  $\text{Zn}^{+2}$ ,  $\text{Mg}^{+2}$  cations.

#### **COURSE OUTCOME:**

After completion of this course students will be able to

1. analyze the structure of boron, carbon, nitrogen, oxygen.
2. examine the reducing and oxidizing nature of boron, carbon, nitrogen, oxygen, and halogen.
3. justify the formation of hydrides, halides and oxides.
4. identify the fundamental aspects of Stereochemistry and its influence on chemical reaction on organic compounds.
5. acquire knowledge on identification of inorganic radicals.

#### **Books for Reference:**

1. Puri B.R. Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, Milestone Publishers, Delhi (2008)
2. Gopalan R., Inorganic Chemistry for undergraduate students, Universities Press(India) Pvt.ltd.,Hyderabad(2009)
3. Soni P.L.,Mohan Katyal,Text book of Inorganic chemistry,20<sup>th</sup> edition,Sultan Chand & Son,New Delhi (1992)
4. Puri B.R.,Sharma L.R., Pathania M.S., Principles of Physical Chemistry, Vishal Publishing Co., Jalandar, (2004)
5. ArunBahl, Bahl .B.S.,Tuli G.D., Essentials of Physical , Multi colour edition,S. Chand & Company Ltd., New Delhi, (2008).
6. Morrison R.T., Boyd R.N. Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., (2006).
7. Jain M.K.,Sharma S.C., Modern Organic chemistry,Vishal Publishing Co., Jalandar, (2012)
8. Frank J. Welcher and Richard B. Hahn, Semi micro Qualitative Analysis, New Delhi, Affiliated East-west Press pvt.Ltd. (1969).
9. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2<sup>nd</sup> edition, Sultan Chand & sons, New Delhi, (1997).
10. D. Nasipuri, Stereochemistry of organic compounds-Principles and applications, New Age

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>III</b>	<b>20U3CHC4</b>	<b>AGRICULTURAL CHEMISTRY</b>	<b>3</b>	<b>3</b>

## Objectives

1. To have an idea about the basic introduction of soil and properties of soil.
2. To develop the skill in specific area of the role of fertilizer in function of plants.
3. To have an idea about the manufacture of manure and handling the storage practice of compost methods.
4. To make the aware of the fundamental aspects of insecticides, fungicides and herbicides.

### Unit - I

**Soil Science** : Physical properties of soil – structure, retention of water by solid, soil moisture content, soil air, soil temperature – chemical properties of soil – chemical composition – soil colloids and its properties – ion charge reaction – soil colloid as source of plant nutrients – Theories of plant nutrients – soil organic matter – transformation of organic matter Soil reaction – Soil pH – reserve and active acidity – buffer action – effect of soil reaction on nutrients – Acid soil, alkaline soil, saline soil, salinealkaline soil – tolerance by plants.

### Unit -II

**Fertilizer** : Definition – Classification – examples with concerned nutrients – complex and mixed fertilizer, macro and micro nutrients and their functions in plants– **Bio fertilizer**-types–Application, sources and importance of Nitrogen , phosphate and potassium fertilizers.

### Unit - III

**Manures**: Difference between fertilizer and manures – bulky organic manures – handling and storage practice – compost methods – manuring – concentrated organic manures.

### Unit - IV

**Insecticides**: Definition of pesticide – classification of - safety measures – Insecticides – definition – plant product – Inorganic pesticides - organic pesticides – mode of action of DDT, BHC, methoxy chloro, chlordane-Endosulfan organo phosphorous compounds. Compatibility of pesticides and agro chemicals.

### Unit - V

**Fungicides and Herbicides**: Inorganic and organic fungicides and herbicides acaricides, rodenticide , attractants , repellents , fumigants. Act and laws of insects and insecticides.

## COURSE OUTCOME:

After completion of this course students will be able to

1. list the types of soil and its properties.
2. know the role of fertilizer in function of plants.
3. acquire the knowledge on manufacture of manure and handling the storage practice of compost methods.
4. assess the fundamental aspects of insecticides, fungicides and herbicides.



5. get job opportunities in agriculture research farm, paddy processing unit and its soil testing laboratories

**References :**

1. N.C.Brady, the Nature and properties of soils Eurasia publishing house, (p) Ltd. 9<sup>th</sup> Ed. (1984).
2. Biswas, T.D. and Mukeherjee S.K. Text book of soil science (1987).
3. A.J.Daji A Text book of soil science –Asia publishing house, Madras (1970).
4. Donahue, R.L.Miller, R.W.and shickluna, J.C. Soil – An introduction to soil and plant Growth – Prentice Hall of India (P) Ltd., New Delhi(1987).
5. Colling, G.H. Commercial Fertilizers – McGraw Hill Publishing Co., New York(1955)
6. Tisdale, S.L.Nelson , W.L. and Beaton , J.D. Soil fertility and fertilizers. Macmillan publishing company, New York (1990).
7. Hesse, P.R..A text book of soil chemical analysis John Muray, New York (1971).
8. Jackon, M.L., soil chemical analysis. Prentic Hall of India, New Delhi (1958).
9. Buchell, K.H.. Chemical of pesticides – John wiley &Sons, NewYork (1983).
10. Mcinikov, N.N. Chemistry of pesticides Vol.36 of Residue Review-springer verlac, New York (1971).
11. Sree Ramula I, U.S. chemistry of Insecticides and Fungicides – Oxford and IBH publishing (1979).

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III & IV	20U4CHCP3	<b>Inorganic Qualitative Analysis (Non - Semester)</b>	<b>2+3</b>	

### Objectives

1. To provide the option for the students the techniques of semi micro qualitative analysis of inorganic salt mixtures.
2. To provide the option for the students with elimination of interfering acid radicals.

### Semimicro inorganic qualitative analysis

Analysis of a mixture containing two cations and two anions of which one will be an interfering ion using semimicro methods and conventional scheme with hydrogen sulphide.

1. **Cations to be Studied:** lead, copper, bismuth, cadmium, antimony, iron, aluminium, zinc, manganese, cobalt, nickel, barium, calcium, strontium, magnesium and ammonium
2. **Anions to be studied:** Carbonate, Sulphide, Sulphate, nitrate, chloride, bromide, fluoride, borate, oxalate, and phosphate

### Reference:

- I. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons (1997)

Semester	Course Code	Title of the Course	Hours of Teaching/ week	No. of Credits
<b>I &amp; III</b>	<b>20U3CHPHA1</b>	<b>Allied Physics –I</b>	<b>5</b>	<b>4</b>

### **Unit I – Elasticity**

Stress – Strain –Hooke’s law-Different moduli of elasticity - Twisting couple on a cylinder – determination of coefficient of Rigidity modulus by Static Torsion method –Bending of beams – Bending moment –Experimental methods for the determination of Young’s modulus by uniform and non-uniform bending – I section girders.

### **Unit – II Sound**

Simple harmonic motion - Composition of two simple harmonic motions (1) along a straight line and (2) at right angles – Lissajous figures and applications – characteristic of musical sound - decibel – phon- intensity - intensity measurement by hotwire microphone method. Acoustics of buildings – Reverberation – Reverberation time- requirements for good acoustics of buildings.

### **Unit – III Thermal Physics**

Newton’s law of cooling –verification-specific heat capacity of a liquid by cooling – Bomb calorimeter – Conduction: Coefficient of thermal conductivity -- Lee’s disc method for bad conductors – Black body radiation- Stefan’s law – Deduction of Newton’s law of cooling from Stefan’s law- Solar constant – Angstrom’s pyrheliometer-temperature of the sun.

### **Unit – IV Optics**

Interference – determination of thickness of a thin wire by air wedge method – Diffraction – Fresnel’s and Fraunhofer diffraction – Transmission grating – theory – Polarization – Elliptically and Circularly polarized light –Nicol prism - Quarter wave plate – Half wave plate – Optical activity – Laurent’s half shade polarimeter.

### **Unit – V Relativity**

Frames of reference – Galilean transformation – inertial and non-inertial frames – Michelson-Morley experiment – Explanations of negative result – postulates of special theory of relativity-Lorentz transformation equations – time dilation – length contraction – variation of mass with velocity – mass- energy equivalence.

### **Books for study**

1. A Text book of sound - N. Subrahmanyam and BrijLal.
2. Allied physics – A. Sundaravelusamy, Priya publications , Karur-2.
3. Properties of matter – R.Murugesan.

Semester	Course Code	Title of the Course	Hours of Teaching / week	No. of Credits
<b>III &amp; IV</b>	<b>20U4CHPHAP</b>	<b>Allied Physics Practicals (NS)</b>	<b>3</b>	<b>2</b>

**List of Experiments Any 14 Experiments**

1. Young's modulus of a given beam – non uniform bending.
2. Rigidity modulus of a rod –Static Torsion
3. Coefficient of viscosity of a given liquid – Graduated burette method.
4. Specific heat capacity of liquid – Newton's law of cooling
5. Newton's rings – Radius of curvature of lens.
6. Air wedge – Thickness of wire
7. Spectrometer prism – A and D
8. Spectrometer grating – a wavelength of various spectral line by normal incidence
9. Field along the axis of the coil
10. Carey Fosters Bridge – specific resistance of a given coil.
11. P.O Box – Specific Resistance
12. Potentiometer – ammeter calibration
13. Figure of merit of a galvanometer –Half deflection method
14. Diode – characteristics
15. Surface tension and interfacial ST – drop weight method
16. Logic gates (AND,OR,NOT) – using discrete components.
17. Verification of Basic Logic gates.

Semester	Subject Code	Title Of The Paper	Hours Of Teaching/ Week	No. of Credits
IV	20U4CHT4	சங்க இலக்கியம் - அறு இலக்கியம் - செம்மொழி தமிழ்- இலக்கிய வரலாறு	6	3

**நோக்கம்:**

- 1.பழந்தமிழ் இலக்கியங்களின் திணைத்துறைக் கோட்பாடுகளை அறிதல்.
- 2.திணைசார் சமுதாய வாழ்வின் பல்வேறுபட்டப் பரிமாணங்களைப்
- 3.புலவர்கள் வாயிலாகவும் திணை இலக்கியத்தின் வாயிலாகவும் அறிதல்.
- 4.பழந்தமிழ் இலக்கியங்களின் உயர்தனித்தன்மை வாய்ந்த சிறப்பியல்புகளை அறிதல்.

**கூறு: 1 எட்டுத்தொகை**

**நேரம்:18**

**குறுந்தொகை**

- 1.குறிஞ்சி : தலைவன் கூற்று-யாயும் ஞாயும் யாராகியரோ - பா.எ.-40
- 2.முல்லை : தலைவி கூற்று-கருங்கால் வேம்பின் ஒண்பூ யாணர் - பா.எ.-24
- 3.மருதம் : தோழி கூற்று-யாய் ஆகியளே விழவு முதலாட்டி - பா.எ.-10
- 4.நெய்தல் : தலைவி கூற்று :நள்ளன் றன்றே யாமம் - பா.எ.-6
- 5.பாலை: செவிலி கூற்று-பறைபடப் பணிலம் - பா.எ.-15

**நற்றிணை**

1. குறிஞ்சி-நின்ற சொல்லர் பா.எ. 1
2. முல்லை:இறையும் அருந்தொழில் -பா.எ.161
3. மருதம்:அறியாமையின் அன்னை - பா.எ.50
4. நெய்தல்:இவளே கானல் நண்ணிய - பா.எ.45
5. பாலை:புணரில் புணராது பொருளே-பா.எ.16

**கலித்தொகை**

1. பாலை: எறித்தரு கதிர் தாங்கி- பா.எ.9
2. குறிஞ்சி : காமர் கடும்புனல்- பா.எ.39

**அகநானூறு**

1. குறிஞ்சி:நீர்நிறம் கரப்ப-பா.எ.18
2. முல்லை: வந்துவினை- பா.எ.44

**கூறு: 2 எட்டுத்தொகை**

**நேரம்:18**

1. ஐங்குறுநூறு : குறிஞ்சி -அன்னாய் வாழிப்பத்து -பா.எ.201-210
2. புறநானூறு : பாடல் எண்கள் - 9,16,20,51,109
3. பதிற்றுப்பத்து:ஆறாம் பத்து- பா.எ.1 வடுவடு நுண்ணுயிர், பா.எ.2.கொடி நுடங்கு நிலைய
4. பரிபாடல் : ஏழாம்பாடல் - வையை

**கூறு: 3 பத்துப்பாட்டு**

**நேரம்:18**

1. குறிஞ்சிப்பாட்டு: முழுவதும்

**கூறு: 4 அறநூல்கள்**

**நேரம்:18**

1. திருக்குறள்: செய்ந்நன்றியறிதல் ,வினைத்திட்டம்,நெஞ்சொடு கிளத்தல்
2. மூதுரை: 1-10 பாடல்கள்
- 3.நல்வழி: 11-20 பாடல்கள்
- 4.நீதிநெறி விளக்கம்: 51-60 பாடல்கள்

**கூறு: 5**

**நேரம்:18**

அ. செம்மொழித் தமிழ்— இலக்கிய வரலாறு :

செம்மொழி வரலாறு : மொழி விளக்கம்-மொழிக்குடும்பங்கள்-உலகச் செம்மொழிகள் - இந்தியச் செம்மொழிகள் — செம்மொழித் தகுதிகள் - வரையறைகள் - தமிழின் தொன்மை - தமிழ்ச் செம்மொழி நூல்கள்.

ஆ. இலக்கிய வரலாறு: சங்க இலக்கியங்கள் ,பதினெண் கீழ்க்கணக்கு நூல்கள்

**பயன்கள்**

1.பழந்தமிழ் இலக்கியங்களை ஆய்வியல் நோக்கில் அணுகுவதற்கான வழிமுறைகளை உணர்த்துதல்.

2.பண்டைத்தமிழரின் அக, புற வாழ்வியலை மாணவர்கள் அறியச் செய்தல்

3.அறத்தின் பெருமையை உணர்வர்

4.ஒழுக்க நெறிகளைப் பின்பற்றுவர்

5.தமிழ் செம்மொழியின் பண்புகளை உணருதல்

6.சங்க இலக்கியத்தின் தொன்மை உணர்தல்

Semester	Course Code	Title of The Course	Hours of Teaching/ Week	No. of Credits
<b>IV</b>	<b>20U4CHE4</b>	<b>PART - II English For Competitive Examinations</b>	<b>6</b>	<b>3</b>

**Objective**

- **To prepare the learners for competitive examinations and to teach the fundamentals of practical communication.**

**Unit – I**

**Grammar** – Number, Subject, Verb, Agreement, Articles, Sequence of Tenses, Common Errors

**Unit – II**

**Word Power** - Idioms & Phrases, one-word substitutes, Synonyms, Antonyms, Words we often confuse, foreign words & phrases, spelling.

**Unit – III**

Reading & Reasoning – Comprehension, Jumbled Sentences.

**Unit – IV**

**Writing Skills** – Paragraph, Précis Writing, Expansion of an idea, Report Writing, Essay, Letters, Reviews (Film & Book)

**Unit – V**

**Speaking**- Public speaking, Group Discussion, Interview, Spoken English.

**Course outcomes**

**After the completion of this course students will be able to**

- **develop English language skills by equipping themselves to face competitive exams**
- **improve English language abilities and gain the skills of writing and vocabulary building**
- **gain confidence to face competitive exams**
- **assimilate grammatical rule clearly and precisely**
- **hone their presentation and public speaking skills**

**Prescribed Text:**

*English for Competitive Examinations*, NCBH, Chennai, Dec. 2019.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
IV	20U4CHC5	General Chemistry – IV	6	5

### Objectives

1. To study about the chemical aspects of Metallurgy.
2. To strengthen the knowledge about the compounds of d block elements and f block elements.
3. To learn the methodology about the extraction of lanthanides and actinides.
4. To know the chemical conversions and applications of alcohols and alkyl halides.
5. To motivate the learner to study about rate and mechanism of chemical reactions and theories of reaction rate and catalysis.

### Unit – I: Metallurgy

Occurrence of metals – minerals & ores – mineral wealth of India

**Concentration of ores:** Froth floatation, magnetic separation, liquation, leaching.

**Production of the metal:** calcinations, roasting, smelting, aluminothermic process and amalgamation. Electro metallurgy and Hydro metallurgy – fluxing process

**Purification of metals:** Poling, electrolysis, zone refining, cupellations, Van Arkel and de Boer methods – Microbial metallurgy.

### Unit – II: Transition and inner transition elements

**‘d’ block elements:** Electronic configuration – general periodic trend – group study of iron, copper and zinc – galvanization.

**Iron:** Commercial forms - manufacture of cast iron.

**Steel:** Classification and heat treatment - alloys of steel (composition and uses).

**f - Block Elements:** Electronic configuration. Lanthanides and actinides: Occurrence, oxidation states, magnetic properties, colour (not for actinides) and spectra – lanthanide and actinide contraction - differences between lanthanides and actinides - separation of lanthanides by ion exchange and solvent extraction methods – uses of lanthanides and actinides - extraction and properties of thorium.

### Unit - III

**Alcohols:** Classification and nomenclature – General methods of preparation, physical & chemical properties aliphatic alcohols - industrial preparation of ethanol – preparation, properties and uses of glycerol.

**Ethers:** Classification and nomenclature: Preparation, physical & chemical properties of Diethyl ether and Anisole – estimation of methoxy group by Zeisel’s method.

**Crown ethers:** Introduction – structures – uses.

### Unit - IV

**Chemical Kinetics:** Rate of a reaction, rate equation, order and molecularity of reaction. Factors influencing the reaction rate – zero, first, second and third order reactions and their characteristics- pseudo uni molecular reaction - derivation of rate constants for first and second order reactions (equal initial concentration) – derivation of time for half change with examples. Methods of determination of order of reactions - Effect of temperature on reaction rate – concept of activation energy, energy barrier - Arrhenius equation. **Theories of reaction rates:** collision theory – absolute reaction rate theory (ARRT) for a bimolecular reaction



## UNIT - V

**Catalysis:** General characteristics of a catalyst - Types: Homogeneous and heterogeneous catalysis, positive and negative catalysts, acid – base, induced, auto and enzyme catalysis – promoter – catalytic poisoning (anti catalyst) - intermediate compound theory and adsorption theory catalysis. Factors increasing and decreasing the catalytic activity - mechanism and characteristics of enzyme catalysis – Michaelis-Menton equation

**Adsorption:** Types – characteristics of adsorption - comparison of chemisorption and physisorption - Isotherms: Freundlich and Langmuir adsorption isotherms.

**Colloids:** Definition - types - stability - gold number - kinetic, optical and electrical properties. Emulsion and Gels: Types of emulsions, preparation, properties and application.

### COURSE OUTCOME:

After completion of this course students will be able to

1. apply the chemical aspects of Metallurgy.
2. distinguish the compounds of d and f block elements.
3. analyze the preparation and properties of alcohols and ethers.
4. know the rate, mechanism and order of chemical reactions.
5. acquire knowledge on catalysis, adsorption, colloidal and application in industry.

### Books for Reference:

1. Puri B.R. Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, Milestone Publishers, Delhi (2008)
2. Gopalan R., Inorganic Chemistry for undergraduate students, Universities Press(India) Pvt.ltd.,Hyderabad(2009)
3. Soni P.L.,Mohan Katyal,Text book of Inorganic chemistry,20<sup>th</sup> edition,Sultan Chand & Son,New Delhi (1992)
4. Puri B.R.,Sharma L.R., Pathania M.S., Principles of Physical Chemistry, Vishal Publishing Co., Jalandar, (2004)
5. ArunBahl, Bahl .B.S.,Tuli G.D., Essentials of Physical chemistry , Multi colour edition, S. Chand & Company Ltd., New Delhi, (2008).
6. Morrison R.T., Boyd R.N. Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., (2006).
7. Bahl B.S. Arun Bahl, Advanced Organic Chemistry, S. Chand & Company Ltd., New Delhi, (2005).
8. Jain M.K.,Sharma S.C., Modern Organic chemistry, Vishal Publishing Co., Jalandar, (2012)

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III & IV	20U4CHCP3	<b>Inorganic Qualitative Analysis (NS)</b>	2+3	3

### **Semimicro inorganic qualitative analysis**

Analysis of a mixture containing two cations and two anions of which one will be an interfering ion using semimicro methods and conventional scheme with hydrogen sulphide.

3. **Cations to be Studied:** lead, copper, bismuth, cadmium, antimony, tin, iron, aluminium, zinc, manganese, cobalt, nickel, barium, calcium, strontium, magnesium and ammonium
4. **Anions to be studied:** Carbonate, Sulphide, Sulphate, nitrate, chloride, bromide, fluoride, borate, oxalate, and phosphate

### **Reference:**

Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons (1997)

Semester	Course Code	Title of the Course	Hours of Teaching/ week	No. of Credits
<b>II &amp; IV</b>	<b>20U4CHPHA2</b>	<b>Allied Physics –II</b>	<b>5</b>	<b>4</b>

#### **Unit – I Magnetism**

Gauss's law for magnetism - Diamagnetism - Paramagnetism - Ferromagnetism- Properties - Electromagnetism: Magnetic field intensity - Biot-Savart's law -Magnetic field due to straight current carrying conductor - field along the axis of a coil - solenoid - Ampere's theorem.

#### **Unit – II Electricity**

Kirchhoff's laws and their applications -Wheatstone's Bridge - Carey Foster's Bridge. Electromagnetic induction: Laws of electromagnetic induction - expression for induced e.m.f - self inductance of a solenoid - Rayleigh's method - Mutual inductance of solenoids- coefficient of coupling -Eddy currents and its applications.

#### **Unit – III Atomic Physics**

Vector atom model - quantum numbers - Pauli's exclusion principle - Periodic classification of elements - Photoelectric effect - Einstein's photo electric equation - experimental verification - Photomultiplier tube. X - rays : continuous and characteristic X-rays -Mosley's law and its importance - Bragg's Law - Bragg 's spectrometer -Crystal structure determination.

#### **Unit – IV Nuclear Physics**

Nuclear size -mass - charge - spin magnetic moment - packing fraction - nuclear stability and binding energy - Liquid-drop model - shell model - nuclear fission - multiplication factor - critical size - chain reaction - nuclear fusion -stellar energy - Thermonuclear reaction - controlled thermonuclear reaction - nuclear reactor.

#### **Unit – V Electronics**

Necessity of modulation - Different types of modulation -Demodulation - junction Diode Detector - Ionosphere and propagation of radio waves - AND,OR,NOT,NOR,NAND gates - Laws of Boolean algebra - De'Morgan's theorems - NAND and NOR as Universal building block.

#### **Books for study**

1. Modern Physics – R. Murugesan and Kiruthikaprasath
2. Electricity & Magnetism – BrijLal and N. Subramanyam
3. Allied physics – A. Sundaravelusamy, Priya publications , Karur-2.

Semester	Course Code	Title of the Course	Hours of Teaching / week	No. of Credits
<b>III &amp; IV</b>	<b>20U4CHPHAPL</b>	<b>Allied Physics Practicals (NS)</b>	<b>3</b>	<b>2</b>

**List of Experiments Any 14 Experiments**

1. Young's modulus of a given beam – non uniform bending.
2. Rigidity modulus of a rod –Static Torsion
3. Coefficient of viscosity of a given liquid – Graduated burette method.
4. Specific heat capacity of liquid – Newton's law of cooling
5. Newton's rings – Radius of curvature of lens.
6. Air wedge – Thickness of wire
7. Spectrometer prism – A and D
8. Spectrometer grating – a wavelength of various spectral line by normal incidence
9. Field along the axis of the coil
10. Carey Fosters Bridge – specific resistance of a given coil.
11. P.O Box – Specific Resistance
12. Potentiometer – ammeter calibration
13. Figure of merit of a galvanometer –Half deflection method
14. Diode – characteristics
15. Surface tension and interfacial ST – drop weight method
16. Logic gates (AND,OR,NOT) – using discrete components.
17. Verification of Basic Logic gates.

Semester	Subject Code	Title of the Paper	Hours of Teaching/Week	No. of Credits
V	20U5CHC6	Organic Chemistry – I	5	6

### Objectives

1. To learn about the comprehensive knowledge and understanding on the carbonyl compounds, organo nitrogen compounds and qualitative analytical methods to identify the functional groups.
2. To impart about the strong foundation in the mechanistic aspects of reactions and applications and entrepreneurial skills in the manufacturing and processing of the synthetic reagents.
3. To enable the learning of name and synthesis of heterocyclic compound.
4. To have an idea about the basic fundamentals of colours in dye and manufacturing of soap and detergent.

### UNIT - I

**Carbonyl Compounds:** Introduction – nomenclature of carbonyl compounds. - reactivity of carbonyl group – activity of alpha hydrogen - mechanisms of Aldol, Perkin, Knoevenagel, Benzoin condensations and Claisen, Reformatsky, Wittig, Cannizzaro, haloform reactions - reduction mechanisms of sodium borohydride, lithium aluminum hydride - WolfKishner, Clemenson and MPV reductions - Oppenauer oxidation - Michael addition reaction.

### UNIT - II

**Mono carboxylic acids:** Nomenclature – acidity – influence of substituents on acidity (aliphatic and aromatic acids) – ortho effect – reactions. *Dicarboxylic acids* :Nomenclature, - acidity - preparation and properties of oxalic, malonic, succinic, glutaric and adipic acids. **Characteristics of reactive methylene group:** Synthetic uses of malonic and acetoacetic esters. **Tautomerism:** definition – Keto – Enol tautomerism (identification, acid and base catalysed mechanisms)

**Esters** : Nomenclature – general methods of preparation- chemical properties and uses.

### UNIT - III

**Nitrogen compounds** : Nomenclature - nitro alkanes - alkyl nitrites - differences – nitro aci nitro tautomerism. *Aromatic nitro compounds*: Reduction of nitro benzene under different conditions. *Amines* :Gabrial phthalimide synthesis, Hoffmann degradation- separation of mixture of amines by Hoffmann method and Hinsberg method - effect of substituent's on basicity and comparison of aliphatic and aromatic amines - mechanism of carbylamines reaction and diazotization. *Diazomethane, benzene diazonium chloride and diazo acetic ester*: Preparation and synthetic importance.

### UNIT - IV

**Heterocyclic compounds:** Nomenclature. *Furan, pyrrole, thiophene* : preparation and properties. *Pyridine*: synthesis and reactions - comparison of the basicities of pyrrole, pyridine and piperidine with amines. *quinoline, isoquinoline and indole* : Synthesis with special reference to Skraup, Fischer Napieraloki and Fischer - indole syntheses and properties

### UNIT - V

**Dyes:** Theory of color - chromophore, auxochrome, classification according to application and structure - preparation and uses of Malachite green, Indigo, Alizarin dyes.

**Benzenesulphonic acid - saccharin, chloramines- T, sulphonamides, sulphanilic acid Sulphanilamide:** Preparation, properties and uses.

**Polymers:** Definition – classification of polymers-mechanism of cationic, anionic and free radical polymerization –thermo setting polymers – preparation of Nylon 66, polyester, bakelite.

**Oils and fats - fatty acids** – Introduction- manufacture of soap - mechanism of cleaning action of soap-detergents-merits and demerits of soap and detergent.

### **COURSE OUTCOME:**

After completion of this course students will be able to

1. acquire knowledge on name reactions and its mechanism.
2. apply the manufacturing skill in processing of the synthetic reagents.
3. know the preparation and properties of Nitrogen compounds.
4. analyze the preparation and properties of heterocyclic compound.
5. get job opportunities in dye, soap , detergents and polymer industry.

### **Books for Reference:**

1. Finar I.L, Organic Chemistry, Vol 1&2, (6th edition) England, Addison Wesley. Longman Ltd. (1996)
2. Morrison R.T., Boyd R.N., Organic Chemistry, (6th edition) New York, Allyn & Bacon Ltd., (2006)
3. Bahl B.S, Arun Bahl, Advanced Organic Chemistry , (12th edition) New Delhi, Sultan Ch and Co., (1997).
4. Pines S.H., Organic Chemistry, (4th edition) New Delhi, Mc Graw - Hill International Book company (1986)
5. Seyhan N. Ege., Organic Chemistry, New York, Houthton Mifflin Co., (2004)
6. Soni P.L.,Chawla H.M., Text book of Organic chemistry, 29<sup>th</sup> edition, Sultan Chand & Son, New Delhi (2007)
7. Jain M.K., Sharma S.C., Modern Organic chemistry, Vishal Publishing Co., Jalandar, (2012)
8. Pillai C.N., Organic Chemistry for undergraduate students, Universities Press(India) Pvt.ltd., Hyderabad(2008).
9. Bahl B.S. Arun Bahl, Text book of Organic Chemistry, Multi colour edition, S. Chand & Coy Ltd., New Delhi, (2006).

Semester	Subject Code	Title of the Paper	Hours of Teaching/ Week	No. of Credits
V	20U5CHC7	Physical Chemistry – I	5	6

### Objectives

1. To apply the principle of chemical and physical states of various systems and their coexistence in equilibrium.
2. To apply the mathematical concept of efficient way of converting work in to energy and vice versa from the thermodynamics perspective.
3. To understand the chemical aspects of metallic mixtures composition and properties through phase diagrams.
4. To learn about solutions, their types, colligative properties, effect of added salt and molecular weight determination.

### UNIT - I

**Thermodynamics:** Definitions of System, surrounding, isolated, closed and open systems, state of the system, Intensive and extensive variables. *Thermodynamic processes:* Reversible and irreversible, isothermal and adiabatic processes - state and path functions - exact and inexact differentials.

**First law of thermodynamics:** Statement - definition of internal energy (E), enthalpy (H) and heat capacity. Relation between  $C_p$  and  $C_v$ . calculation of  $w$ ,  $q$ ,  $dE$  and  $dH$  for expansion of ideal and real gases under isothermal and adiabatic conditions of reversible and irreversible processes. Definition of joule - Thomson coefficient ( $\mu_{J,T}$ ) - calculation of ( $\mu_{J,T}$ ) for ideal and real gases .

**Thermochemistry:** Relation between enthalpy of reaction at constant volume ( $q_v$ ) and at constant pressure ( $q_p$ ) - temperature dependence of heat of reaction - Kirchoffs equation - bond energy and its calculation from thermochemical data - Hess's law of heat summation (statement and applications)

### UNIT - II

**Second law of thermo dynamics :** Need for the law - different statements of the law - Carnot's cycle and efficiency of heat engine - Carnot's theorem - thermodynamic scale of temperature.

**Entropy :** Definition and physical significance of entropy - entropy as a function of P, V and T - entropy changes during phase changes - entropy of mixing - entropy criterion for spontaneous and equilibrium processes in isolated system .

**Gibb's free energy (G) and Helmholtz free energy (A) :** Variation of A and G with P, V and T- Gibb's - Helmholtz equation and its applications - thermodynamic equation of state - Maxwell's relations -  $\Delta A$  and  $\Delta G$  as criteria for spontaneity and equilibrium - advantage of  $\Delta G$  over entropy change.

### UNIT - III

**Third law of Thermodynamics:** Nernst heat theorem - Statement and concept of residual entropy - evaluation of absolute entropy from heat capacity data.

**Equilibrium constant and free energy change:** Thermodynamic derivation of law of mass action - equilibrium constants in terms of pressure and concentration - thermodynamic interpretation of Lechatelier's principle - Van't Hoff's reaction isotherm - Van't Hoff's isochore - Clapeyron equation and Clausius - Clapeyron equation-applications

**Systems variable composition :** Partial molar quantities - chemical potential - variation of chemical potential with T, P and X (mole fraction) - Gibb's Duhem equation.

## UNIT - IV

**Solutions:** Henry's law and Raoult's law - Ideal and non-ideal solutions, concept of activity and activity coefficients – Gibbs - Duhem - Margules equation. *Completely miscible liquid systems:* benzene and toluene - Theory of fractional distillation - azeotropes - HCl - water and ethanol - water systems. *Partially miscible liquid systems* : phenol - water, triethylamine - water and nicotine - water systems. lower and upper CSTs - effect of impurities on CST. *Completely immiscible liquids* : Principle and applications of steam distillation - Nernst distribution law – derivation - applications.

**Dilute solutions:** Colligative properties, lowering of vapour pressure, elevation of boiling point, depression of freezing point, osmotic pressure - determination of molecular masses using the above properties - abnormal molecular masses – (molecular dissociation & association).

## UNIT – V

**Phase rule:** Definition of terms - derivation. *One component systems:* water and sulphur - super cooling - sublimation. *Two component systems:* solid liquid equilibria. *Simple eutectic systems:* (lead-silver, Bi-Cd) - desilverisation of lead - compound formation with congruent melting point. (Mg-Zn) and incongruent melting point (Na-K).

**Solid solutions** : (Ag-Au) - fractional crystallisation.- *Freezing mixtures* : FeCl<sub>3</sub> - H<sub>2</sub>O systems and CuSO<sub>4</sub>-H<sub>2</sub>O system.

## COURSE OUTCOME:

After completion of this course students will be able to

1. know the chemical and physical states of various systems and their coexistence in equilibrium.
2. investigate the efficient way of converting work into energy and vice versa from the thermodynamics perspective.
3. identify the chemical aspects of metallic mixtures composition and properties through phase diagrams.
4. inspect the solutions, their types, colligative properties, effect of added salt and molecular weight determination.

## Book for Reference:

1. Puri B.R., Sharma L.R., Pathania M.S., Principles Of Physical Chemistry, (23rd edition), New Delhi, Shoban Lal, Nagin Chand & Co., (1993)
2. Maron and Prutton, Physical Chemistry, Mac Millan, London.
3. Atkins P.W., Physical Chemistry, (5th edition) Oxford University Press. (1994)
4. Castellan G.V., Physical Chemistry, Orient Longmans, New Delhi.
5. Soni P.L., Dharmaraj O.P., Dash U.N., Text book of physical chemistry, 22<sup>nd</sup> edition, Sultan Chand & Son, New Delhi (2001)
6. Glasstone S., Lewis D. Elements of Physical Chemistry, London, Mac Millan & Co. Ltd.
7. Arun Bahl, Bahl .B.S., Tuli G.D., Essentials of Physical , Multi colour edition, S. Chand & Company Ltd., New Delhi, (2008).



Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	20U5CHC8	Inorganic Chemistry	5	6

### Objectives

1. To familiarize the basic concept of coordination compounds, their structural and theories of coordination compounds
2. To develop the skill in specific area of bioactivity of proteins, enzymes, metals, vitamins, hemoglobin and myoglobin.
3. To learn about solids, their properties, close packing in crystals, and use of X-rays in crystal structure determination.
4. To know about the organo metallic compounds of ferrocene, binary compounds, clathrates and structure of silicates.

### UNIT - I

**Coordination compounds:** Introduction, characteristic of coordination compounds-simple salt, Double salt, coordination compounds- Terminology - Central metal ion – ligands-types of ligands– coordination number, oxidation numbers, and coordination sphere – Nomenclature - Werner’s theory of complexes sidgwicks theory - EAN rule, VB theory- applications and its limitations.

**Applications of coordination chemistry:** Estimation of nickel using DMG and aluminium using oxine - estimation of hardness of water using EDTA

### UNIT - II

**Crystal Field theory:** postulate of crystal field theory, Shape of d-orbital- Crystal field splitting in octahedral, tetrahedral and square planar fields – factors influencing the magnitude of crystal field splitting – magnetic properties and colour.

**Labile and inert complexes-** stepwise and overall stability constants.

**Reaction mechanism** – substitution reactions in octahedral complexes – Acid hydrolysis: SN1 and SN2 mechanisms – Complementary and non- complementary reactions- Trans effect.

### UNIT - III

**Biologically important coordination compounds:** Structure and application Chlorophyll, hemoglobin, vitamin B<sub>12</sub> – role of alkali and alkaline earth metals in biological systems.

**Metal carbonyls** - synthesis and structure of mono nuclear carbonyls of Ni, Fe, Cr, and bi nuclear carbonyls of Co, Mn - synthesis and structure .

**Nitrosyl compounds:** Classification, preparation and properties - structure and uses of sodium nitroprusside.

#### UNIT - IV

**Solid state** : Isotropic and anisotropic solids – Interfacial angle – symmetry elements in crystal systems – Bravais lattices - Unit cell – law of rational indices (Weiss indices), Miller indices – unit cell dimension – density – number of atoms per unit cell – X-ray diffraction by crystals – derivation of Bragg's equation – Experimental methods of X-ray study- rotating crystal method – X-ray pattern by powder method – crystal structure of KCl, NaCl, ZnS, CsCl – Radius ratio and packing in crystal.

#### UNIT – V

**Organo metallic compounds**: Introduction - *Ferrocene*: preparation , property, structure and stability – *Zeigler natta catalyst*. *Binary compounds* : hydrides ,borides (structure, properties and uses), Boranes (structure of Diborane only) carbides (classification and applications only) and Boron nitride and Borazole (structure only) – Clathrates (examples , applications, formation in quinol). *Silicones*: composition, manufacture, structure, properties and uses.

**Silicates**: Different types with examples and structures.

#### COURSE OUTCOME:

After completion of this course students will be able to

1. illustrate the concept of coordination compounds, their structural and theories of coordination compounds
2. examine the bioactivity of proteins, enzymes, metals, vitamins, hemoglobin and myoglobin.
3. acquire knowledge on Structure and application of chlorophyll, hemoglobin, vitamin B<sub>12</sub> –in biological systems.
4. explain the ferrocene, binary compounds, clathrates and structure of silicates.

#### Books for Reference:

1. Soni P.L., Text Book of Inorganic Chemistry, S, Chand & Co, New Delhi (2006).
2. Madan R.D.,Juli G.D and Malik S.M.,Selected Topics in Inorganic Chemistry, S.Chand & Co.,NewDelhi (2006) 4.Lee J.D.,Concise Inorganic Chemistry, ELBS Edition.
3. Puri B.R. Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, Milestone Publishers, Delhi (2008)
4. Gopalan R., Inorganic Chemistry for undergraduate students, Universities Press(India) Pvt.ltd.,Hyderabad(2009)
5. Lee J.D., Concise Inorganic Chemistry, UK, Black well science (2006).

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	20U5CHCP4	Physical Chemistry practical	3	4

### Objectives

1. To enable the learning the fundamentals of conductometric titrations.
2. To make the student know about the method of determination of critical solution temperature, transition temperature and rate constant.
  1. Determination of Partition coefficient of iodine between Carbon tetrachloride
  2. Determination of rate constant of acid catalyzed hydrolysis of an ester (Methyl acetate or ethyl acetate).
  3. Determination of molecular weight by Rast's method using naphthalene, di phenyl, m- di nitro benzene as solvents and benzamide, naphthalene, acetanilide, di phenyl as solutes.;
  4. Determination of CST of Phenol
  5. Effect of impurity on CST of Phenol
  6. Determination of transition temperature of crystal hydrates such as sodium thio sulphate, sodium acetate, strontium chloride, manganese chloride.
  7. Phase diagram of Naphthalene – Di phenyl amine system, Naphthalene – Di phenyl , Naphthalene – m – di nitro benzene, Naphthalene – p- nitro toluene.
  8. Determination of strength of NaOH solution by Conductometric titrations using standard HCl acid.
  9. Determination of strength of KMnO<sub>4</sub> solution by Potentiometric titrations using standard FAS solution.
  10. Determination of cell constant

### Reference:

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, Sultan Chand & sons, New Delhi, (1997)

Semester	Subject Code	Title of the Paper	Hours of Teaching/ Week	No. of Credits
V	20U5CHEL1A	<b>Major elective - I PHARMACEUTICAL CHEMISTRY</b>	4	4

### Objectives

1. To understand the about the terminology and important drugs and the mode of actions.
2. To prepare the student to gain in depth knowledge in application of disinfectants and antiseptics.
3. To impact the awareness about the function of analgesic and antipyretics.
4. To have an idea about the antibiotics.
5. To apply the principle to know the estimation of sugar and hemoglobin.

### UNIT-I

**Terminology:** Drugs, Pharmacy, Pharmacology, Pharmacognosy, Toxicology, Chemotherapy, Medicinally important compounds-Aluminium Alum, Aluminium hydroxide gel - Phosphorous –Phosphoric acid, Hypo phosphorus acid-Iron-Ferrous gluconate - Ferrous sulphate-Preparation, Properties ad uses.

### UNIT-II

**Analgesic and Antipyretics:** Types-Narcotic analgesics –Morphine, Heroin, Pethidine - Structure and Uses. Non-narcotic analgesics-Aspirin, MethylSalicylate, Paracetamol, Phenactin- Preparation, Properties and Uses. Analgin, Indometacin, Sulindac Ibuprofen-Structure and Uses.

### UNIT-III

**Antibiotics:** Introduction, Pencillin – Types, Structure, Properties, assay, SAR chloroamphenicol, Structure Properties, SAR. Streptomycin–Structure, Properties and Uses.

### UNIT – IV

~~**Blood:** Composition of blood, Function of erythrocytes, leucocytes, platelets, Blood grouping and matching, Anticoagulant drugs, Haematological agents. Coagulation or blood clotting, Physiological function of plasma protein, Role of blood as oxygen carrier.~~

### UNIT – V

**Clinical Chemistry:** Determination of sugar(glucose) in serum – Folin and WV's method- O-toluidine method – diagnostic test for sugar in urine-Benedict's test, Determination of serum cholesterol- Sacketles method for total cholesterol-detection of cholesterol in urine- detection of anaemia- estimation of haemoglobin(Hb concentration)- red cell count-Principle, Apparatus and Reagents and Procedure.

## **COURSE OUTCOME:**

After completion of this course students will be able to

1. know the terminology and important of drugs and the mode of actions.
2. distinguish the disinfectants and antiseptics.
3. identify the function of analgesic and antipyretics.
4. acquire knowledge on antibiotics.
5. estimation the sugar level and hemoglobin in blood.
6. get job opportunity in pharma industry as production chemist and quality control officer,

## **REFERENCES**

1. Jayashree Ghosh, A Text Book of Pharmaceutical Chemistry; 5<sup>th</sup> Ed., S.Chand and Company Ltd., New Delhi, 2014.
2. S.Lakshmi; Pharmaceutical Chemistry; 1<sup>st</sup> Ed., S.Chand and Company Ltd., New Delhi, 1995.
3. Bhagavathi Sundari; Applied Chemistry; 1<sup>st</sup> Ed., MJP Publishers, Chennai, 2006.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	20U5CHEL1B	Major Elective - I POLYMER CHEMISTRY	4	4

### Objectives

1. To understand the preparation and applications of Polymers.
2. To learn about the Kinetics of polymers.
3. To learn the methodology about the Characterization.
4. To enable the learning about the Chemical Reaction Cyclization.
5. To learn the methodology about the classification and Molecular weight determination.

### UNIT – I

**Physical Properties and applications:** Mechanical – Stress – strain measurements Electrical – conducting – polyacetylene, polyaniline. Industrially important polymers – Natural and synthetic rubber – polyesters, polytetra fluoroethylene, (TEFLON), Polystyrene - ion exchange resins, polyacrylonitrile – carbon fibres, polyvinyl chloride and polyacrylates

### UNIT – II

**Synthesis and Kinetics:** Kinetics of polymerization – free radical chain polymerization, cationic polymerization, anionic polymerization, copolymerization, Degree of polymerization, chain length, chain transfer, chain termination, stereoregular polymerization, Ziegler-Natta catalysts.

### UNIT – III

**Characterization:** Crystalline Nature – X-ray diffraction, study of polymers, degree of crystallinity, Differential scanning Calorimetry, Thermogravimetric analysis of polymers. Glass Transition Temperature – factors affecting Glass Transition Temperature, properties associated with Glass Transition Temperature, Crystallinity and Melting point – Relations to structure.

### UNIT – IV

**Chemical Reaction in Cyclization:** Hydrolysis, Acidolysis, Hydrogenation, Addition and substitution reaction cross linking – Vulcanization, graft and Block Copolymers. Type of degradation – Thermal Mechanical, Oxidative, Hydrolytic and photo degradation.

### UNIT – V

**Classification and Molecular weight Determination:** Basic concepts of polymer science – molecular forces and chemical bonding in polymers – classification of polymer – addition polymers, condensation. Major mass and size of polymers – Number average and weight average molecular weight – methods of molecular weight determination. Osmometry viscosity, light scattering, sedimentation, Ultracentrifuge; Molecular weight distribution curve.

## **COURSE OUTCOME:**

After completion of this course students will be able to

1. know the preparation and applications Polymers.
2. acquire knowledge on synthesis and kinetics of polymers.
3. identify about the chemical Reaction in cyclization.
4. predict different methods of determining the molecular weight.

## **References:**

1. V.R. Gopwrikar – polymer science, wiley Eastern, 1986
2. K.J. Saunders, Organic Polymer Chemistry – Chapman and Hall, 1976
3. Raymond, B. Seymour, Polymer Chemistry – An introduction, Marcel Dekker Inc. NY 1981
4. Fred W. Billmeyer – Text book of polymer science, john – wiley.
5. K. Gupta, fundamentals of polymer science and Engineering, Tata, McGraw Hill.
6. Stepak, polymer characterization of processing technology, Academic press, Indian.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	20U5CHEL2A	<b>Major Elective - II ANALYTICAL CHEMISTRY</b>	5	3

### Objectives

1. To demonstrate the extension of the concept competence in collecting and interpreting data from their knowledge on analytical techniques.
2. To develop the skill in specific area about the techniques of gravimetric analysis.
3. To know about thermo gravimetric analysis, differential thermal analysis and its applications.
4. To interpret the principle of chromatographic techniques such as TLC, GLC, HPLC and their applications industries, research fields and in day to day life.

### UNIT - I

**Error analysis:** Types of errors-minimizing errors - significant figures - accuracy - methods of expressing accuracy - precision - methods of expressing precision - mean, median, mode, mean deviation, standard deviation and confidence limits – Q test- correlation co-efficient.

**Estimations of commercial samples:** Determination of percentage purity in washing soda and Bleaching power - estimation of glucose and phenol.

### UNIT – II

**Gravimetric analysis:** Principle - theories of precipitation - solubility product and precipitation – conditions of precipitations - specific and selective precipitants, organic and inorganic precipitants - purity of precipitates – co precipitation & post precipitation - precipitation from homogeneous solution - use of sequestering agents

### UNIT – III

**Chromatography:** Adsorption and partition Chromatography principle - *Paper chromatography*: Principle, development of chromatogram, ascending, descending and radial techniques – *Thin layer chromatography*: Choice of adsorbent , experimental methods -  $R_f$ -values and factors affecting the  $R_f$  values – applications of TLC. Superiority of TLC over paper chromatography - *Column chromatography*: Preparation of the column, elution, recovery of substances and applications.– *Gas chromatography*: Principles and technique. *Ion - exchange chromatography*: Principle - requirements of a good resin - experimental techniques - *High Pressure Liquid Chromatography (HPLC)*: Principles and advantages.

### UNIT – IV

**Thermo analytical methods:** Principles of TGA, DTA and DSC - Characteristics of TGA ( $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ ,  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ) and DTA ( $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ ) curves - factors affecting TGA and DTA curves - applications of TGA and DTA.

**Electro analytical techniques:** Theory of electro gravimetric analysis - determination of Copper (by constant current procedure). *Electrolytic separation of metals*: Principle - separation of copper and nickel,

**Coulometry:** principle - Coulometry at controlled potential - apparatus and technique - separation of nickel and cobalt.



## UNIT – V

**Colorimetry and spectrophotometry:** principle of colorimetric analysis - colorimetric estimation of  $\text{Ni}^{+2}$  and  $\text{Fe}^{+3}$  - spectrophotometric determination of chromium.

**Separation Purification techniques:** principle involved in separation by precipitation and Solvent extraction - principles of crystallization, fractional crystallization - Principles and techniques of sublimation and solvent extraction (soxhlet extraction), simple, fractional and steam distillation, distillation under reduced pressure - Desiccants.

### COURSE OUTCOME:

After completion of this course students will be able to

1. relate the competence in collecting and interpreting data on analytical techniques.
2. know the techniques of gravimetric analysis.
3. acquire knowledge on application of thermo gravimetric analysis and differential thermal analysis.
4. analysis the chromatographic techniques such as TLC, GLC, HPLC.
5. choose the job opportunities in industries and research fields.

### Book for Reference:

1. Douglas A. Skoog and Donald M. West, F.J. Holler, Fundamentals of Analytical Chemistry, 7th edition, Harcourt College Publishers.
2. Mendham J., Denney R.C., Barnes J.D., Thomas M., Vogel's Text book of Quantitative Chemical analysis, 6<sup>th</sup> edition, Pearson education.
3. Gopalan. R., Subramaniam P.S. and Rengarajan K., Elements of Analytical Chemistry, Sultan Chand and Sons, NewDelhi(2000).
4. Usharani S., Analytical Chemistry, Macmillian India Ltd., NewDelhi(2000)
5. B.K. Sharma, Instrumental methods of Chemical analysis, Himalaya Publ. House, Delhi, 2006.

Semester	Subject Code	Title of the Paper	Hours of Teaching/Week	No. of Credits
V	20U5CHEL2B	Major elective - II BIOCHEMISTRY	5	3

### Objectives :

1. To enable the student to develop a sound knowledge of fundamental concepts in biochemistry.
2. To enumerate the molecular motif of a living cell, structural and functional hierarchy of biomolecules.
3. To emphasis on the various aspects of metabolism and interrelationship of metabolic events.

### UNIT 1: Amino acids and Proteins

**Living Cell** – Plant and Animal cell. Cell membrane – organelles – functions of major subcellular components – Anabolism and catabolism and their relation to metabolism. **Amino acids** – classification –Synthesis of  $\alpha$ -amino acids and their identification. Peptide bond- stereochemistry, synthesis of peptides by solution and solid phase techniques. **Proteins** – classification – properties-3D structure-determination of amino acid sequence – denaturation and renaturation of protein molecules. Separation and purification of proteins – dialysis – gel filtration - electrophoresis. Catabolism of amino acids: Transamination, oxidative deamination, decarboxylation. The urea cycle and other possibilities of detoxification of ammonia.

### UNIT 2 : Enzymes

Nomenclature, classification and properties-specificity, factors influencing enzyme action. Mechanism of enzyme action – Lock and Key model and induced fit models. Coenzymes – cofactors – prosthetic groups of enzymes (TPP, NAD, NADP, FAD, ATP). Their importance in enzyme action. Mechanism of inhibition (competitive, non- and uncompetitive and allosteric). Immobilization of enzymes. Enzyme specificity,

### UNIT 3: Lipids

Classification - neutral lipids, Phospho lipids (lecithines, cephalins, plasmalogens) and glycolipids – importance, synthesis and degradation. Fatty acids – saturated, unsaturated fatty acids, EFA. Properties – Hydrolysis-acid number, saponification number. Auto-oxidation (Rancidity), addition reactions-Iodine value, Polenske number, Reichert-Meissl number, acetyl number. Hydrogenation Cholesterol – biosynthesis. Bile salts derived from cholesterol. Metabolism: Oxidation of glycerol –  $\alpha$ -oxidation of fatty acids; biosynthesis of lipids – synthesis of fatty acids and synthesis of triglycerides.

### UNIT 4: Carbohydrates

Classification – reducing and non-reducing sugars. Glucose: structure-conformation – stability Carbohydrates of the cell membrane – starch, cellulose and glycogen. (Structure and utility) Metabolism: Glycolysis and its reversal; TCA cycle. Relation between glycolysis and respiration. Principles of bioenergetics, electron transport chain and oxidative phosphorylation.

## **Unit 5 Nucleic Acids**

Nucleosides and nucleotides – purine and pyrimidine bases. Nucleic acids Difference between DNA and RNA. Classification of RNA. Biosynthesis of DNA: Replication. Biosynthesis of mRNA: Transcription. Genetic code – mutations and mutants. DNA repair. Biosynthesis of proteins. DNA sequencing and PCR, recombinant DNA technology, DNA polymorphism.

### **COURSE OUTCOME:**

After completion of this course students will be able to

1. develop a sound knowledge of fundamental concepts in biochemistry.
2. enumerate the molecular motif of a living cell, structural and functional hierarchy of biomolecules.
3. emphasis on the various aspects of metabolism and interrelationship of metabolic events.

### **Reference books**

1. Robert L.Caret, Katherine J. Denniston, Joseph J. Topping, Principles and Applications of organic and biological chemistry, WBB publishers, USA, 1993.
2. J. L. Jain, Biochemistry, Sultan Chand and Co.1999
3. A. Mazur and B. Harrow, Text book of biochemistry, 10th Edition, W.B. Saunders Co., Philadelphia, 1971.
4. Paula Yurkanis Bruice, Organic chemistry, 3rd Edition, Pearson Education, Inc. (Singapore), New Delhi, reprint, 2002.
- 5.P. W. Kuchel and G. B. Ralston, Shaum Series, Theory and Problems of Biochemistry, McGraw-Hill Book Company, New York, 1988.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
V	20U5CHLSD	Life skill development	1	

### Course objectives

- To enhance one's ability to be fully self aware by helping oneself to overcome all fears and insecurities and to grow fully from inside out and outside in.
- To increase one's knowledge and awareness of emotional competency and emotional intelligence at place of study/work.
- To provide opportunity for releasing one's potential through practical experience.
- To develop interpersonal skills and adopt good leadership behaviour for empowerment of self and others.
- To set appropriate goals, manage stress and time efficiently.
- To manage competency- mix at all levels for achieving excellence with ethics.

### Unit – I (30 hrs)

#### Communication and Professional skills

1. Writing and different modes of writing. (4 hrs)
2. Digital Literacy. (4 hrs)
3. Effective use of social media. (3 hrs)
4. Non verbal communication. (2 hrs)
5. Resume skills. (3 hrs)
6. Presentation skills. (4 hrs)
7. Listening as a Team skill. (2 hrs)
8. Brainstorming. (2 hrs)
9. Social and cultural Etiquettes. (4 hrs)
10. Internal communication. (2 hrs)

## Unit – II (30 hrs)

### Leadership, management and Universal Human Value

1. Leadership skills.	(4 hrs)
2. Managerial skills.	(4 hrs)
3. Entrepreneurial skills.	(4 hrs)
4. Innovative Leadership and Design thinking.	(4 hrs)
5. SWOT Analysis	(4 hrs)
6. EQ	(2 hrs)
7. Love and Compassion.	(4 hrs)
8. Truth.	(1 hr)
9. Non Violence.	(1 hr)
10. Righteousness.	(1 hr)
11. Ethic and Integrity.	(1 hr)

### Course outcomes

At the end of the programme learners will be able to:

- Gain Self Competency and Confidence.
- Practice Emotional Competency.
- Gain Intellectual Competency.
- Gain an edge through Professional Competency.
- Aim for high sense of Social Competency.
- Be an integral Human Being.

Semester	Subject Code	Title of the Paper	Hours of Teaching/ Week	No. of Credits
VI	20U6CHC9	Organic Chemistry – II	5	6

## Objectives

1. To understand the knowledge of fundamental concepts of carbohydrates.
2. To have an idea about the chemistry of amino acids, proteins, nucleic acids and vitamins.
3. To get knowledge to elucidate the structure of alkaloids and terpenoids.
4. To learn the application of some named reactions.
5. To know the chemical processes involved in the preparation of phenol.

## UNIT - I

**Carbohydrates:** Classification - properties, structure and configurations of mono saccharides (glucose and fructose) - interconversion - ascending and descending series - mutarotation, epimerisation - determination of ring size of glucose - cyclic forms of other mono saccharides - structural elucidation of sucrose, maltose – structures of starch and cellulose – properties of starch – glycogen, inulin, cellulose nitrate, cellulose acetate and mercerized cotton (simple treatment).

## UNIT - II

**Amino acids:** Classification, general methods of preparation and reactions of amino acids, zwitter ion - isoelectric points, action of heat on  $\alpha$ ,  $\beta$  and  $\gamma$  amino acids.

**Peptides and proteins:** Peptide linkage - polypeptide - end group analysis - synthesis of peptides - Merrifield synthesis.

**Proteins:** Classification - denaturation - colour reactions – primary, secondary and tertiary structures

**Vitamins:** Classification, biological importance of vitamins A, B<sub>1</sub>, B<sub>2</sub>, B<sub>6</sub>, B<sub>12</sub> and C.

## UNIT – III

**Alkaloids:** isolation, physiological activities -classification, general methods of elucidating structure - structural elucidation and synthesis of coniine, nicotine and piperine

**Terpenes:** classification - isoprene rule, general methods of structural elucidation - synthesis and uses of citral, geraniol, nerol,  $\alpha$  – terpeniol and menthol,.

## UNIT - IV

**Molecular rearrangements:** Types of rearrangements (nucleophilic and electrophilic). *Mechanism with evidence for the following re-arrangements:* pinacol - pinacolone, benzil- benzilic acid, benzidine, Claisen, Fries, Hofmann, Curtius, Lossen, Beckman, dienone – phenol.

## UNIT - V

**Phenols:** Classification and nomenclature – esterification, halogenation, coupling with diazonium salt, Kolbe, Reimer Teimann, Gattermann, Houben Hoesch, Lederer Manasse reactions (mechanism not needed) and uses. *Cresol (o,m and p), Nitrophenol and Amino phenol* : preparation and properties.

**Nucleic acids: Structure** 0- purine and pyrimidine bases – nucleosides, nucleotides – DNA and RNA – structure and functions.

**Enzymes:** Introduction, classification – Mechanism of enzyme action, Factors affecting enzyme activity.

### **COURSE OUTCOME:**

After completion of this course students will be able to

1. name the fundamental concepts of carbohydrates.
2. predict the chemistry of amino acids, proteins, nucleic acids and vitamins.
3. elucidate the structure of alkaloids and terpenoids.
4. list the application of some named reactions.
5. categorize the chemical processes involved in the preparation of phenol.

### **Books for Reference:**

1. Finar I.L, Organic Chemistry, Vol 1&2, 6<sup>th</sup> edition, Addison Wesley. Longman Ltd., England (1996).
2. Bahl B.S, Arun Bahl, Advanced Organic Chemistry , 12<sup>th</sup> edition, Sultan Chand and Co., New Delhi (1997).
3. Pines S.H., Organic Chemistry, 4<sup>th</sup> edition, McGraw - Hill International Book company, New Delhi (1986).
4. Seyhan N. Ege., Organic Chemistry, Houthton Mifflin Co., New York, (2004)
5. Soni P.L.,Chawla H.M., Text book of Organic chemistry,29<sup>th</sup> edition,Sultan Chand & Son, New Delhi (2007)
6. Jain M.K.,Sharma S.C., Modern Organic chemistry,Vishal Publishing Co., Jalandar, (2012)
7. Pillai C.N.,Organic Chemistry for undergraduate students, Universities Press(India)Pvt.ltd., Hyderabad(2008).
8. Bahl B.S. Arun Bahl, Text book of Organic Chemistry, Multi colour edition,S. Chand & Coy Ltd., NewDelhi,(2006).
9. Bhupinder Mehta and Manju Mehta “Organic Chemitry”, PHI Learning Pvt Ltd, New Delhi – 110001.(2012)
10. V.K.Ahluwalia, R.K.parashar, Organic reaction mechanism, Naosa publication

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
VI	20U6CHC10	Physical Chemistry – II	5	6

### Objectives

1. To familiarize the basic concept of electrochemistry and they understand the practical use of electricity and their laws.
2. To understand about the nature of electrolytes and their theories and the concept of emf and its application.
3. To learn about the use of ultra violet spectroscopy and apply the infrared spectroscopy to chemical compounds.
4. To acquire the steps in photo chemistry and the direct and indirect uses of photo chemistry.

### UNIT - I

**Ionic mobility:** Transport number - Hittorf's rule - determination by Hittorf's method and moving boundary method - Kohlrausch's law and its applications (Determination of equivalent conductance of weak electrolytes, determination of transport number) - application of conductance measurements (determination of solubility product of a sparingly soluble salt and conductometric titrations) - elementary treatment of the Debye - Huckel- Onsager equation for strong electrolytes (no derivation) - evidence for ionic atmosphere - conductance at high frequencies (Debye - Falkenhagen effect) and at high fields (Wein effect).

### UNIT - II

**Electrochemical Cells:** Galvanic cell - Daniel cell - half cell - Nernst equation of electrode potential - cell diagram and terminology - single electrode potential - sign convention - reversible and irreversible cells - types of electrodes (metal/metal ion, Gas, metal/insoluble salt and redox electrodes) - standard electrode potentials - standard hydrogen electrode - calomel electrode - electrochemical series and its significance - EMF of a galvanic cell and feasibility of cell reaction - calculation of thermodynamic quantities of cell reactions ( $\Delta G$ ,  $\Delta H$ ,  $\Delta S$  and equilibrium constant).

**Concentration cell:** With and without transport- liquid junction potential. *Application of EMF measurements:* Valency of doubtfulion, solubility products, pH using hydrogen and quinhydrone electrodes, Potentiometric titrations (acid - base, redox and precipitation)

### UNIT - III

**Electromagnetic spectrum :** The regions of various types of spectra.

**Microwave spectroscopy:** Rotational spectra of diatomic molecules treated as rigid rotator, condition for a molecule to be active in microwave region, rotational constants (B), and selection rules for rotational transition - frequency of spectral lines, calculation of inter - nuclear distance in diatomic molecules.

**Infrared spectroscopy :** Vibrations of diatomic molecules - harmonic and unharmonic oscillators, zero point energy, dissociation energy and force constant, condition for molecule to be active in the IR region, selection rules for vibrational transition, fundamental bands, overtones and hot bands, diatomic vibrating rotator - P, Q, R branches - determination of force constant.

**UV visible spectroscopy:** conditions Franck - Condon principle - pre dissociation.



#### UNIT - IV

**Raman spectroscopy:** Rayleigh scattering and Raman scattering. Stokes and antistokes lines in Raman spectra, Raman frequency, quantum theory of Raman effect, condition for a molecule to be Raman active - comparison of Raman and IR spectra- structural determination from Raman and IR spectroscopy, rule of mutual exclusion.

**NMR spectroscopy :** Nuclear spin and conditions for a molecule to give rise to NMR spectrum- theory of NMR spectra, number of NMR signals, equivalent and non - equivalent protons, position of NMR signals, shielding, de-shielding, chemical shift  $\delta$  and  $\tau$  scales. Peak area and number of protons - splitting of NMR signals - spin - spin coupling-

#### UNIT - V

**Photo Chemistry :** Consequences of light absorption - Jablonski diagram- radioactive and non - radioactive transitions (fluorescence, phosphorescence) - Lambert – Beer, Grothus - Draper and Stark – Einstein law - quantum efficiency - photo chemical reactions - kinetics of  $H_2-Cl_2$  and  $H_2-Br_2$  reactions - comparison between thermal and photochemical reactions - photo sensitization and quenching - chemiluminescence - lasers (simple treatment) and its application.

**Macromolecules:** Molecular weight of macro molecules – determination of molecular weight by osmotic pressure and light scattering methods.

#### COURSE OUTCOME:

After completion of this course students will be able to

- recognize the electrochemical process and evaluate the electrode and cell.
- illustrate the theories of emf and its application.
- apply the ultra violet and infrared spectroscopy to identify the chemical compounds.
- characterize the unknown molecules using Raman and NMR spectroscopy.
- practice of common photochemical and photo physical methods.

#### Books for Reference :

1. Maron S.H. and Lando J.B., Fundamentals of Physical Chemistry, Mac Millan & Co. Ltd., London
2. Glasstone S. and Lewis D., Elements of physical Chemistry ,Mac Millan & Co. Ltd., London
3. Khterpal S.C. Pradeeps, Physical Chemistry, Volume I & II, Pradeep publications Jalandhur, (2004).
4. Jain D.V.S and Jainhar S.P., Physical chemistry, Principles and problems, Tata Mc Graw Hill, New Delhi, (1988).
5. Puri B.R., Sharma L.R., Pathania M.S., Principles of Physical Chemistry, 23<sup>rd</sup> edition, Shoban Lal, Nagin Chand & Co., New Delhi, (1993)
6. Atkins P.W., Physical Chemistry, (5th edition) Oxford University Press. (1994)
7. Castellan G.V., Physical Chemistry, Orient Longmans. New Delhi.
8. Soni P.L., Dharmarah O.P., Dash U.N., Text book of physical chemistry, 22<sup>nd</sup> edition, Sultan Chand & Son, New Delhi (2001)
9. ArunBahl, Bahl .B.S., Tuli G.D., Essentials of Physical , Multi colour edition, S.Chand & Company Ltd., New Delhi, (2008)

Semester	Subject Code	Title of the Paper	Hours of Teaching/Week	No. of Credits
VI	20U6CHC11	INORGANIC CHEMISTRY - II	5	5

### Objectives

1. To introduce the salient aspect to the fundamentals of nuclear chemistry.
2. To impact the awareness of the chemistry of radioactive elements.
3. To understand the terms of theories of acid and bases.
4. To impart students understand about glass and alloys preparation, uses and their applications.
5. To enable the learning about the polymers, fibers, cements preparation, uses and their applications.

### UNIT I

**Nuclear Chemistry – I :** Nuclear particles - composition of nucleus - nuclear forces - packing fraction - mass defect - binding energy - nuclear stability - shell and liquid drop nuclear models – magic numbers. *Isotopes:* Detection and separation - deviation of atomic weights from whole numbers – isobars, isotones and mirror nuclei.

### UNIT II

Radioactivity :Discovery -  $\alpha$ ,  $\beta$ ,  $\gamma$  rays –detection (by Wilson cloud chamber) and measurements (Geiger – Muller counter) of radiation - group displacement law - rate of disintegration - half life and average life, - radioactive series - nuclear transmutation – types of nuclear transmutations - particle accelerators (cyclotron only) - nuclear fission- nuclear reactors – fast breeder reactor (FBTR) – atom bomb – nuclear fusion – hydrogen bomb - applications of nuclear science in agriculture and medicine- carbon dating - rock dating.

### UNIT III

**Structure of alloys:** Substitutional and interstitial solid solutions - Hume Rothery ratio.

**Semi conductors:** Extrinsic and intrinsic, n-type and p-type, transistors – uses.

**Solvents for inorganic reactions:** Definition and examples of protic, aprotic, polar, non-polar, non-aqueous solvents.

**Acid Base -** Theories of acids-bases- Arrhenius, Bronsted – Lowry, Lewis, Solvent system (levelling and differentiating effect), Lux - Flood and Usanovich definition – HSAB principle

### UNIT IV

**Fossil fuels :** Varieties of coal and petroleum - petroleum refineries in India.*Fuel gases:* Calorific value – units of heat - composition and preparation of water gas, semi water gas, carbureted water gas, producer gas, natural gas, LPG and biogas.

**Fertilizers:** Essential nutrients for plants –functions N,P,K nutrients- manufacture of urea, calcium superphosphate, potassium sulphate and mixed fertilizers - micronutrients and their role in plant life.

**Pesticides:** Insecticides (stomach & contact poison and fumigant), fungicides, herbicides, rodenticides and their adverse effect – alternative methods for pest control.

**Safety matches, fireworks:** Manufacturing details

## UNIT V

**Cement:** Classification – functions of ingredients of Portland cement - manufacture – Chemistry of setting of cement

**Glass:** Manufacture-different types of glasses – uses.

**Paints and varnishes:** Constituent's oil paint –paint pigments –mechanism of drying - **Special paints:** Heat resistant, fire retardant, chemical resistant, temperature indication, luminous, water repellent, anti fouling paints.-oil and spirit varnishes-enamels and lacquers.

**Water pollution:** Various water pollutants (sewage, infectious agents, plant nutrients, exotic organic chemicals, inorganic minerals and chemical compounds) and their adverse effect.

### COURSE OUTCOME:

After completion of this course students will be able to

- know about the fundamentals of nuclear chemistry.
- acquire knowledge on the chemistry of radioactive elements.
- recognize the applications of semi conductors and theories of acid and base.
- categorize the glass, paint and cements of their applications.
- choose job opportunities in petroleum refineries, cement and paint industry.

### Books for Reference:

1. Soni P.L., Text book of Inorganic Chemistry, S.Chand & Co, New Delhi (2006)
2. Lee J.D., Concise Inorganic Chemistry, Black well science, UK (2006).
3. Puri B.R. and Sharma L.R., Principles of Inorganic Chemistry, Soban Lal Nagin Chand & Co. New Delhi,
4. Satyaprakash, Tuli, G.D., Basu, S.K., and Madan, R.D,] Advanced Inorganic chemistry (vol I & II), S. Chand, New Delhi (2006)
5. Gopalan R., Inorganic Chemistry for undergraduate students, Universities Press(India) Pvt.ltd.,Hyderabad(2009)
6. Arhnickner, Nuclear chemistry

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
VI	20U6CHCP5	Gravimetric and Organic preparation practical	5	5

## Objectives

1. To prepare the student to gain in depth knowledge the techniques of gravimetric analysis.
2. To provide the option for the methods of preparing organic compounds.

### Gravimetric Estimation:

1. Estimation of Barium as Barium chromate
2. Estimation of Barium as sulphate.
3. Lead as chromate.
4. Lead as sulphate.
5. Estimation of Calcium as oxalate mono hydrate
6. Nickel as Di Methyl Glyoxime complex
7. Magnesium as magnesium or oxinate.
8. Copper as cuprous thiocyanate.
9. Estimation of chloride as silver chloride.

### A. Organic preparation:

1. Oxidation: Benzoic acid from benzaldehyde
2. Hydrolysis: Salicylic acid from salicylaldehyde
3. Nitration : m-Dinitro benzene from nitro benzene
4. Nitration: Picric acid from phenol
5. Bromination: Tri bromo aniline from aniline
  - i. Tri bromo phenol from phenol
  - ii. p- Bromo acetanilide from acetanilide
6. Osazone from glucose

### Reference:

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, Sultan Chand & sons, New Delhi, (1997)

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No. of Credits
<b>VI</b>	<b>20U6CHEL3A</b>	<b>Major Elective – III INDUSTRIAL CHEMISTRY</b>	<b>4</b>	<b>4</b>

## Objectives

1. To learn about the cosmetics and perfumes
2. To understand about the pesticides
3. To have an idea about the fermentation in industries
4. To apply the principle the process about the Pulp, paper industries and Rubber industries

### Unit – I

#### Cosmetics and perfumes

A general study including preparation and uses of the following: Hair dye, hair spray, Shampoo, Sun-tan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirant and artificial flavours. Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, e-phenyl ethyl alcohol, Jasmone, civetone, Muscone.

### Unit – II

#### Pesticides

General introducing to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides, structure activity relationship, synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexene); Organophosphates (Malathion, Parathion); Carbamates (carbofuran and carbaryl); Quinones (Chloranil), Anilides (Alachlor and Butachlor).

### Unit – III

#### Fermentation Industries

Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Pencillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamine B2 Vitamine B12 and Vitamine C.

### Unit - IV

#### Pulp and paper industries

Sulphite, sulphate, soda, ground wood pulp for paper - Manul of paper – specialty paper – paper – paper stock – structural Boards, Plastics – Manufacture – resin – Manufacturing process – Condensation Polymerization Manufacture of laminates and other derivatives – Hexamethylene tetramine plastics – esters.

### Unit - V

#### Rubber industries

Natural – synthetic rubber – Monomer production – Synthetic polymerization – Butadiene – Styrene copolymers – Butadiene acrylonitrile copol Neoprene – Thiokol – Silicon rubber – Butyl rubber – Urethane rubber – Rubber pre chemicals – Rubber compounding – Rubber fabriation – Latex compound – reclaimed Rubber – derivatives.

## **COURSE OUTCOME:**

After completion of this course students will be able to

- acquire knowledge of importance of cosmetics and perfumes in everyday life.
- analyze the adverse effects of pesticides.
- know the production of organic material from fermentation Industries.
- infers the process of pulp, paper and rubber industries.

## **References:**

1. Norrish Shreave. R. and Joseph A. Brink Jr Chemical Process Industries, McGraw Hill, Industrial Book Company London.
2. Brain A.C.S. Reinhold, Production and properties of Industrial chemicals — New York.
3. Burgh, A. Fermentation Industries, Inter science, New York.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
VI	20U6CHEL3B	<b>Major Elective – III FOOD AND NUTRITION</b>	4	4

**Objectives:**

1. To motivate the learner about the importance of food and nutrition.
2. To impact the awareness about the chemical composition and importance of balanced diet.
3. To provide the option for the students to identify the food adulterants and identification of them.

**Unit - I: Food, nutrition and health**

The meaning of food, nutrition, nutritional care and health-nutritional problems in India.

**Unit - II: Biological importance of food**

Nutritional classification of food-nutrients as body constituents-digestion and absorption of food. Types of food, caloric content and dieting.

**Unit - III: Basic chemical constituents of food**

Biological functions of carbohydrates, proteins, fats, vitamins, minerals and water.

**Unit - IV: Food adulteration testing**

Common adulterants in food-testing methods of all food adulterants.

**Unit - V: Health problems of food adulteration**

Principal adulterants and their health effects.

**COURSE OUTCOME:**

After completion of this course students will be able to

- identify the importance of food and nutrition.
- investigate the chemical composition and importance of balanced diet.
- recognize the food adulterants and identification of them.

**References**

1. Alex Ramani V, Food Chemistry, MJP Publishers, Triplicane, Chennai, 2009.
2. Thangamma Jacob, Food adulteration, Macmillan company of India limited, New Delhi, 1976.
3. Jeyaraman J, Laboratory manual in biochemistry, Wiley Eastern limited, New Delhi, 1981.

Semester	Subject Code	Title of the Paper	Hours of Teaching/Week	No. of Credits
VI	20U6CHEL4A	Major Elective – IV DYE CHEMISTRY	4	3

## Objectives

1. To strengthen the knowledge about the main purpose of dyeing and how fabrics are dyed in industry.
2. To enable the learning about the dyeing is the application of dyes or pigments on textile materials.
3. To know about dyes may require a mordant to improve the fastness of the dye on the fiber.
4. To understand that pretreatment is a heart of processing of textile.

## Unit - I

**Basic concepts of colour chemistry:** Colour and sensation - theories of colour and chemical constitution – Witt's theory - chromophore - auxochrome – chromogen – batho chromic and hypsochromic shifts – resonance and valence bond theories – requirements of a dye - classification of dyes based on their their structures and use.

**Synthesis of few dyes:** Bismark brown, Congo red, Malachite green, Crystal violet, Magenda (Rosaniline), Alizarin, Indigo dyes and fluorescein.

## Unit - II

**General properties of dye stuff:** Linearity, co-planarity -Washing, light, rubbing and sweating, gas fading and sublimation fastness,

**Fiber Science :** classification fibres — properties such as count, denier , tex, staple length, spinning properties, strength, elasticity and creep - general characteristics of cotton, silk and wool - chemical natures of cellulosic and proteneous fibers - preparation and properties of nylon 6,6, polyester, viscose.

## Unit - III

**Pretreatment of fibers :** Singing – Singing techniques - sizing & desizing - hydrolytic and enzymatic desizing methods - scouring - Kier boiling method - bleaching methods ( with hypochlorite, peroxide, and bleaching powder) – mercerization .

**Technical terms in dyeing:** M.L.ratio – % of shade – % of exhaustion – equilibrium absorption. **Dye bath assistants:** Exhaust agents and their mechanism - wetting agents (TR oil) and leveling agents (anionic, cationic and non-ionic) with their mechanisms.

## Unit - IV

**Dyeing processes -I:** *Vat dyeing:* Vatting, dyeing, oxidation and after treatment steps. *Reactive dyeing:* Hot and cold brand reactive dyes – principles involved in the dyeing process. *Dyeing of polyester:* principle – carrier dyeing – functions of carrier – functions of dispersing agents - high temperature dyeing. *Ingrain dyes:* azoic colours with one example.



## Unit – V

**Dyeing processes - II:** *Acid dyeing:* Mechanism of acid dyeing – role of electrolytes. *Mordant dyes:* chrome mordant process. *Oxidation colours:* Aniline black and dyeing of mineral khakhi and *Combination shades.*

**Textile finishing:** Water proofing, moth proofing proofing , mildew and fire proofing

**Dyeing machineries:** Padding mangle, Jigger, Winch and soft flow machines.

**Non textile uses of dyes:** Leather dyeing, paper dyeing, solvent dyes ,food colours, hair colours and fluorescent brightening agents

### COURSE OUTCOME:

After completion of this course students will be able to

- predict the purpose of dyeing and how fabrics are dyed in industry.
- acquire the knowledge on pre treatment of textile fibers.
- know they require mordant to improve the fastness of the dye on the fiber.
- choose the job opportunity as dye chemist, production in charge and quality control in dye industries.

### REFERENCE:

1. V.A.Shenai, An introduction to dyes stuff and intermediate–Sevak publication, Mumbai.
  2. V.A.Shenai , vol. IV, Technology of textile processing, Sevak publication , Mumbai.
  3. V.A.Shenai, vol. I, Textile fibres, Sevak publication , Mumbai.
  4. V.A.Shenai, vol.III , Techniques of bleaching, Sevak publication ,Mumbai.
  5. V.A.Shenai , vol.II, Principle of dyeing , Sevak publication, Mumbai.
  6. Soni P.L.,Chawla H.M., Text book of Organic chemistry,29<sup>th</sup> edition,Sultan Chand & Son, NewDelhi (2007)
- Jain M.K.,Sharma S.C., Modern Organic chemistry,Vishal Publishing Co., Jalandar, (2012)
7. Bahl B.S. Arun Bahl, Text book of Organic Chemistry, Multi colour edition, S.Chand & Coy Ltd., NewDelhi,(2006).
  8. Abraha. E.N.Dyes and their intermediates-, Bergamon Press, 1969.
  9. Lubs. H.A, The chemistry of synthetic dyes and pigments-,ACS Publication, Halner, 1970.
  10. Venkataraman . K. The chemistry of synthetic dyes Vol, I, II, III & IV-, Academic Press N.Y., 1949.
  11. [http://en.wikipedia.org/wiki/Hair\\_coloring](http://en.wikipedia.org/wiki/Hair_coloring)
  12. [http://www.pbm.com/~lindahl/articles/food\\_coloring\\_agents.html](http://www.pbm.com/~lindahl/articles/food_coloring_agents.html)
  13. [http://en.wikipedia.org/wiki/Food\\_coloring](http://en.wikipedia.org/wiki/Food_coloring)

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
<b>VI</b>	<b>20U6CHEL4B</b>	<b>Major Elective – IV CLINICAL CHEMISTRY</b>	<b>4</b>	<b>3</b>

### Objectives

1. To acquire knowledge about the application of disinfectants and antiseptics.
2. To familiarize the basic concept about the importance of drugs and the mode of actions.
3. To learn about Enzymes, Body fluids and Biotechnology.

### UNIT-1: CLINICAL HYGIENE AND BIOCHEMICAL ANALYSIS

Definition of health. Ryde of WHO. Sterilization of surgical instruments. Disinfectants, antiseptics, sanitation. Biochemical analysis of urine, serum and fecal matter. Treatment for specific poisons-acids, alkalis, arsenic and mercury compounds.

### UNIT-2: COMMON DRUGS

Manufacture of drugs (e.g. quinine, reserpine, atropine and d – tubocurarine) from Indian medicinal plants. Testing of drugs : biological variation, screening and toxicity. Use of pharmacopoeia and therapeutic index. Types of drugs and their modes of action : Depressant drugs (special reference to sedatives and hypnotics). Anticonvulsant drugs (sodium valproate, hydantoins). Narcotic analgesics (only morphine compds). Antipyretic analgesics (acetyl salicylic acid, p – amino – phenol derivatives).  
Muscle relaxants.

- i. Acting at neuromuscular junction (d – tubocurarine chloride).
  - ii. Acting at spinal cord alone (glyceryl guaicolate, diazepam).
- Antibiotics (penicillin, streptomycin, tetracyclin, chloramphenicol)  
Cardiovascular drugs-nitrates, beta blockers(propranolol and atenolol) and calcium channel blockers.  
h) nuclear medicine (Radiation therapy)

### UNIT-3: ENZYMES

Classification, specificity. Coenzymes, Cofactor, ATP, Mechanism of enzyme action and Immobilisation of enzymes.

### UNIT-4: BODY FLUID

Blood volume, blood groups, coagulation of blood. Plasma lipoproteins. Blood pressure. Arteriosclerosis, diseases affecting red cells: Hyperchromic and hypochromic anaemia. Blood transfusion. Blood sugar and diabetes.

### UNIT-5: BIOTECHNOLOGY:

Heredity, recombinant DNA, Genetic engineering and its possible hazards, Gene splicing, manufacture of interferon and human insulin(Humulin), Drug manufacture based on fermentation(only antibiotics)

### COURSE OUTCOME:

After completion of this course students will be able to

- identify the application of disinfectants and antiseptics.
- know the importance of drugs and the mode of actions.
- define the Enzymes, Body fluids and Biotechnology.

**Text Books**

Jayashree Ghosh, A text book of Pharmaceutical Chemistry, S.Chand and Co. Ltd, 1999.  
S.C. Rastogi, Biochemistry, Tata McGraw Hill Publishing Co., 1993  
Ashutosh Kar, Medicinal Chemistry, Wiley Eastern Limited, New Delhi, 1993.

**Reference Books**

1. O.Le Roy, Natural and synthetic organic medicinal compounds, Ealemi., 1976.
2. B.L. Oser, Hawk's physiological chemistry, 14th edition, Tata-McGraw - Hill Publishing Co.Ltd, 1965.

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No. of Credits
<b>I&amp;II</b>	<b>20U2CHS1</b>	Skill Based Elective -I <b>Textile Processing</b> (Non –Semester)	<b>1</b>	<b>2</b>

## Objectives

1. To learn about the main purpose of dyeing.
2. To understand about how fabrics are dyed in industry.
3. To have an idea about the application of dyes or pigments on textile materials.
4. To know about dyes may require a mordant to improve the fastness of the dye on the fiber.

## Unit-I

**Textile fiber and pretreatment:** Classification of textile fibers – concept and techniques of Ginning, Sizing, Desizing, Scouring, Bleaching, and Mercerization - fiber identification tests (Flame test – microscopical & solubility test)

**Dye chemistry:** Colour and sensation - theories of colour and chemical constitution – Witt’s theory - chromospheres - auxochrome – chromogen - classification of dye based on application .

## Unit-II

**Technical terms in dyeing:** M.L.ratio – % of shade – % of exhaustion – equilibrium absorption.

**Dye bath assistants:** Explanation and mechanism of exhausting agent, wetting agent, leveling agent, dispersing agent and carrier.

**Fastness properties** – Light, Washing Rubbings and sublimation fastness.

**Textile proofing** – Water proofs, moth proofing, mildew proofing & fire proofing.

**Dyeing machineries:** Padding mangle, Jigger, and Winch.

**Non textile uses of dyes:** Leather dyeing, paper dyeing, solvent dyes, food colours, hair colours and fluorescent brightening agents

## COURSE OUTCOME:

After completion of this course students will be able to

1. list the main purpose of dyeing.
2. justify how fabrics are dyed in industry.
3. know the application of dyes or pigments on textile materials.
4. assess the dyes may require a mordant to improve the fastness of the dye on the fiber.

**References:**

1. Venkataraman . K. The chemistry of synthetic dyes Vol, I, II, III & IV-, Academic Press N.Y., 1949.
2. [http://en.wikipedia.org/wiki/Hair\\_coloring](http://en.wikipedia.org/wiki/Hair_coloring)
3. [http://www.pbm.com/~lindahl/articles/food\\_coloring\\_agents.html](http://www.pbm.com/~lindahl/articles/food_coloring_agents.html)
4. [http://en.wikipedia.org/wiki/Food\\_coloring](http://en.wikipedia.org/wiki/Food_coloring)
5. Shenai, V.A. ,Chemistry of Textile fibres, vol.I, Sevak publication , Mumbai
6. Shenai, V.A. ,Chemistry of Dyes and Principles of dyeing , vol.II, Sevak publication, Mumbai

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No. of Credits
III & VI	20U4CHS2	Skill Base Elective - II <b>Food Preservation</b> (Non –Semester)	1	2

**Objectives:**

1. To prepare the student to gain in depth knowledge the importance of food preservation.
2. To have an idea about how to control water activity moisture food.

**UNIT I :**

Low-temperature preservation: Refrigeration, Freezing, Industrial freezers, Quality of frozen foods , Thermal processing: Canning ,Pre – sterilization procedures , Sterilization , Quality of canned foods – Pasteurization , Asepticprocessing (Commercial sterility, Packaging aseptically processed products)- Blanching .

**Unit II:**

Controlling water activity: Dehydration and Concentration of moist foods- Fermentation and pickling: Pickled fruits and vegetables, Pickled meat,Deterioration of fermented and pickled products-Chemical preservation: Organic chemicalpreservatives, Inorganic chemical preservatives- Food irradiation - Biological effects ofirradiation: Positive effects, Negative effects.

**COURSE OUTCOME:**

After completion of this course students will be able to

1. list the importance of food preservation.
2. acquire knowledge to control water activity moisture food.

**References:**

1. Angela Williams Duea,The Complete Guide to Food Preservation: Step-by-stepInstructions on how to Freeze, Dry, Can, and Preserve Food,Atlantic PublishingCompany, 2011
2. Preserving Food without Freezing or Canning: Traditional Techniques Using Salt, Oil,Sugar, Alcohol, Vinegar, Drying, Cold Storage, and Lactic Fermentation, helsea GreenPublishing, 04-Apr-200
3. Christina Ward, Preservation: The Art and Science of Canning, Fermentation andDehydration (Process Self-reliance Series) Paperback Process Media, June 20, 2017
4. <https://www.biotecharticles.com/Others-Article/Food-Preservation-Techniques-PDF-4153.html>
5. <https://www.britannica.com/topic/food-preservation/Sterilization>.

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No. of Credits
<b>VI</b>	<b>20U6CHNME</b>	<b>Non-major elective course</b> <b>Chemical aspects in Agriculture</b>	<b>2</b>	

## Objectives

1. To have an idea about the basic introduction of soil and properties of soil.
2. To develop the skill in specific area of the role of fertilizer in function of plants.
3. To have an idea about the manufacture of manure and handling the storage practice of compost methods.
4. To make the aware of the fundamental aspects of insecticides, fungicides and herbicides.

## Unit I

Soil : Mechanical Components Constitution, Profile, Types – Functions of sand ,silt and Clay – Textural grouping of Soil – Soil Water : Hygroscopic, Capillary and Gravitational water – Soil Humus – Soil pH, Acidity and alkalinity –Formation of Acid Soil and its reclamation, formation of Alkaline soil, Saline soil ,Saline soil and its reclamation.

Fertilizers: Plant nutrients –Requisites of good fertilizers Effect of Nitrogen on plant growth, deficiency symptoms - Nitrogenous fertilizers: Classification with examples - Effect of Phosphorous on plant growth, deficiency symptoms – Posphatic fertilizers - Classification with examples - Effect of Potassium on plant growth, deficiency symptoms - Potassium fertilizers: Classification with examples – Complex and Mixed fertilizers (mere explanation) – Functions of micro nutrients

## Unit II

Mannures: Farm yard manure–Compost making – Green manuring - Concentrated organic manures: Oil cakes ,Blood meal, Fish manure, Horn & Hoof meal, Protein – Difference between fertilizer and manure – Superiority of manure over fertilizer

Bio fertilizers: Rhizobium, Azospirillum, Azatobacter, Cyani bacteria, Phospho bacteria

Pesticides: Clssification on the basis of mode of action, types of pests and Chemical nature with examples – safety measures while using pesticides - Organic insecticides: Nicotine ,Pyrethrum ,Rotenone, Petroleum oils, Summer oils , Dormant oils and sphy oils – Uses of Inorganic pesticides (Arsenials, Fluorides and Borates) – Actions of DDT, Methoxy Chlor,BHC,Chlordan,Endosulfan, Organic Phosphide compounds

Fungicide ,Herbicides, Acaricides, Rodenticides ,Attractants, Repellants, Fumigants, Defoliants (Definitions and Examples)

Act laws of insects and insecticides.

Chemical aspects in Agriculture.

**COURSE OUTCOME:**

After completion of this course students will be able to

1. find the basic introduction of soil and properties of soil.
2. compare about role of fertilizer in function of plants.
3. manufacture manure and handling the storage practice of compost methods.
4. assess the fundamental aspects of insecticides, fungicides and herbicides.