Department of Chemistry

Syllabus for all courses

(With effect from the year 2018-2019)

Department of Chemistry

Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya

(University established under sec 3 of UGC Act 1956)

(Accredited with "A" by NAAC)

Enathur, Kanchipuram – 631 561.Tamilnadu.

B.Sc. Chemistry

Syllabus

(With effect from the year 2018-2019)

Department of Chemistry

Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya

(University established under sec 3 of UGC Act 1956)

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Enathur, Kanchipuram – 631 561.Tamilnadu,

B. Sc [Chemistry] – CURRICULUM *(with effect from 2018-2019)*

Sem	Part	Subject type	Subject Code	Title of the paper	Credit	IA	EA	Tot
I	I	Language	BCHF181TT0	Tamil – I	3	40	60	100
			BCHF181TS0	Sanskrit-I	3	40	60	100
			BCHF181TH0	Hindi-I	3	40	60	100
	II	English	BCHF181T20	English-I	3	40	60	100
	III	Core paper -1	BCHF181T30	General Chemistry – I	5	40	60	100
	III	Non- major paper -1	BCHF181T40	Principles of Environmental Science	4	40	60	100
	III	Allied Paper-1	BCHF181T50	Applied Physics -I	3	30	45	75
	III	Major Practical*	BCHF181P60	Major Practical – I- Volumetric analysis	-	-	-	-
	III	Allied Practical	BCHF181P70	Allied Physics Laboratory	-	-	-	-
	IV	Foundation Course-I	BCHF181T80	Functional English	1	100	-	100
					19			
II	I	Language	BCHF182TT0	Tamil – II	3	40	60	100
			BCHF182TS0	Sanskrit-II	3	40	60	100
			BCHF182TH0	Hindi-II	3	40	60	100
	II	English	BCHF182T20	English-II	3	40	60	100
	III	Core paper- 2	BCHF182T30	General Chemistry - II	5	40	60	100
	III	Non-major paper-2	BCHF182T50	Programming in C	4	40	60	100
	III	Allied Paper-2	BCHF182T40	Applied Physics -II	3	30	45	75
	III	Major Practical	BCHF182P70	Major Practical – I- Volumetric analysis	5	40	60	100
	III	Allied Practical	BCHF182P80	Allied Physics Laboratory	2	20	30	50
	IV	Foundation Course-II	BCHF182T60	Indian Culture	1	100	-	100
					26			
III	I	Language	BCHF183TT0	Tamil – III	3	40	60	100
			BCHF183TS0	Sanskrit-III	3	40	60	100
			BCHF183TH0	Hindi-III	3	40	60	100
	II	English	BCHF183T20	English-III	3	40	60	100
	III	Core paper-3	BCHF183T30	Analytical Chemistry	5	40	60	100
	III	Allied Paper-3	BCHF183T4A	Allied Mathematics-I	4	40	60	100
			BCHF183T4B	Allied Computer Science-I	3	30	45	75
	III	Major Practical*	BCHF183P60	Major practical – II- Qualitative Inorganic analysis	-	-	-	-
	III	Allied Practical	BCHF183P70	Allied Computer Science Laboratory	-	-	-	-
	IV	Open Elective **			1	100	-	100
	IV	Skill Based Elective-I	BCHF183T50	Chemistry in everyday life	1	100	-	100
					17/16			
IV	I	Language	BCHF184TT0	Tamil – IV	3	40	60	100
			BCHF184TS0	Sanskrit-IV	3	40	60	100
			BCHF184TH0	Hindi-IV	3	40	60	100
	II	English	BCHF184T20	English-IV	3	40	60	100
	III	Core paper-4	BCHF184T30	Spectroscopic methods of analysis	5	40	60	100
	III	Allied Paper-4	BCHF184T40	Allied Mathematics-II	4	40	60	100
			BCHF184T50	Allied Computer Science-II	3	30	45	75
	III	Major Practical	BCHF184P60	Major practical – II- Qualitative Inorganic analysis	5	40	60	100
	III	Allied Practical	BCHF184P70	Allied Computer Science Laboratory	2	20	30	50
	IV	Skill Based Elective – II	BCHF184E80	Water analysis and treatment	1	100	-	100
					21/22			
V	III	Core paper-5	BCHF185T10	Inorganic Chemistry – I	5	40	60	100
	III	Core paper-6	BCHF185T20	Organic Chemistry – I	5	40	60	100
	III	Core paper-7	BCHF185T30	Physical Chemistry – I	5	40	60	100
	III	Major Practical	BCHF185P40	Major practical – III Gravimetric analysis	5	40	60	100
	III	Major Practical	BCHF185P50	Major practical – IV Organic analysis	5	40	60	100
	IV	Skill based Elective - III	BCHF185SE1	Chemical Industries- principles and practices	1	100	-	100
					26			
VI	III	Core paper-8	BCHF186T10	Inorganic Chemistry – II	5	40	60	100
	III	Core paper-9	BCHF186T20	Organic Chemistry – II	5	40	60	100
	III	Core paper - 10	BCHF186T30	Physical Chemistry – II	5	40	60	100
	III	Major lab	BCHF186P40	Major practical- V -Physical Chemistry lab	5	40	60	100
	III	Major Project	BCHF186Z50	Project	10	-	100	100
	IV	Skill Based Elective -IV	BCHF186T60	Pharmaceutical Chemistry	1	100	-	100
					31			
				Total	**140**			

* Continued for next semester.

***Any one to be selected by the student. **The student will select one non-core elective paper offered by the university.

This course will facilitate the student to learn a topic of interest other than core subject.

Semester-I

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
I	I	BCHF181TT0	Tamil -I	3	-	1	3

நோக்கம் : *எளிமையான மொழி ஆக்கங்களை அறிந்து கொள்ளும் வகையில் மக்கள் இலக்கியமான நாட்டுப்புற இலக்கிய வகையிலிருந்து சிலவும், உரைநடையின் எளிய வடிவமான சிறுகதைகள் சிலவற்றை அறிமுகம் செய்துவைக்கும் நோக்கில் சிலவும், கவிதை வடிவம் பற்றி உணர பாரதியார் தொடங்கி தற்காலப் புதுக்கவிஞர்கள் சிலரின் படைப்புகளும் தரப்பட்டுள்ளன. அடிப்படை மொழிப்பயிற்சி தரப்பட்டுள்ளது.*

பயன் : *வாழ்க்கையின் அனுபவங்களின், உணர்வுகளின் 'இயல்பான வெளிப்பாடு கலை' என்பதை உணர்தல்; நல்ல, உயர்வான படைப்பாளிகளை அறிந்துகொள்ளுதல்; இலக்கியத் தேடல் ஆர்வத்தைத் தூண்டுதல்.*

அலகு – *1* (12 Hrs)

தமிழ் இலக்கிய வரலாறு

1. நாட்டுப்புற இலக்கிய வரலாறு
   நாட்டுப்புறப் பாடல்கள், நாட்டுப்புறக் கதைகள்,
   நாட்டுப்புறக் கதைப் பாடல்கள், பழமொழிகள்,
   விடுகதைகள்

2. உரைநடை இலக்கிய வரலாறு
   சிறுகதைகள் தோற்றமும் வளர்ச்சியும்

3. கவிதை இலக்கிய வரலாறு
   புதுக் கவிதைகள் தோற்றமும் வளர்ச்சியும்

அலகு – *2* (12 Hrs)

1. வாய்மொழி இலக்கியம் நாட்டுப்புறப் பாடல்கள்
   தாலாட்டு, காதல், ஒப்பாரி

2. புதுமைப்பித்தன் சிறுகதைகள்
   கடவுளும் கந்தசாமிப் பிள்ளையும் , செல்லம்மா
   துன்பக்கேணி, ஆற்றங்கரைப் பிள்ளையார், பொன்னகரம்

அலகு – *3* (12 Hrs)

1. பாரதியார்
   காணி நிலம் வேண்டும், நல்லதோர் வீணை

2. பாரதிதாசன்
   தமிழ்க் காதல், தமிழ் வளர்ச்சி, எந்நாளோ?

3. கவிமணி தேசிய விநாயகம் பிள்ளை
   ஆறு தன் வரலாறு கூறுதல்

அலகு – *3* (12 Hrs)

1. ந. பிச்சமூர்த்தி – வழித்துணை
2. சிற்பி – முள்... முள்.... முள்...
3. அப்துல் ரகுமான் – குருடர்களின் யானை

அலகு – 5 (12 Hrs)

மொழிப் பயிற்சி

1. பொருத்திய சொல் தருதல்
2. மரபுத் தொடர்கள்

பார்வை நூல்கள் :

1. புதுமைப்பித்தன் சிறுகதைகள், பாரி புத்தகப் பண்ணை, 184, பிராட்வே, சென்னை– 108.
2. தமிழக நாட்டுப்புற பாடல்கள், முனைவர். சண்முக சுந்தரம், பூம்புகார் பிரசுரம், சென்னை.
3. புதுக்கவிதை – ஒரு புதுப்பார்வை, பாலா, அன்னம் பதிப்பகம், புதுக்கோட்டை.
4. பாரதியார் கவிதைகள், மாணிக்கவாசகர் நூலகம், சிதம்பரம்.
5. மொழித்திறன் – பூவண்ணன், வர்த்தமானன் பதிப்பகம், தி.நகர், சென்னை.

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
I	I	BCHF181TS0	Sanskrit - I	3	-	1	3

Aim:

- *To understand the value of Sanskrit.*

Objective

- *To make the students comfortable and to have an idea about vowel, consonants and their combination along with their words formation, understanding the uses of nouns and verbs in the field of Sanskrit.*

Outcome

- *To realize the unit features of the Sanskrit language*
- *To throw a light to understand the cultural heritage of India through the language of Sanskrit.*

Unit - I भागः – क (12 Hrs)

1. Vowels & Consonants
2. Words begin with vowels
3. Words begin with **क** to **ण**
4. Words begin with **त** to **ह**

Unit - II भागः – ख (12 Hrs)

1. Words begin with **क** to **झ** with the combination of Vowels.
2. Words begin with **ट** to **न** with the combination of Vowels.
3. Words begin with **प** to **ह** with the combination of Vowels.
4. Combined Letters.
5. Simple Sentences.

Unit - III भागः – ग (12 Hrs)

Lessons from text book 1-6.

Unit - IV भागः – घ (12 Hrs)

Lessons from text book 7-12.

Unit - V भागः – ङ (12 Hrs)

1.शब्दरूपाणि

1. **देवः**
2. **मुनिः**
3. **गुरुः**
4. **पितृ**
5. **गो**
6. **छात्रा**
7. **मतिः**
8. **गौरी**
9. **धेनुः**
10. **मातृ**
11. **वनम्**
12. **अस्मद्**
13. **युष्मद्**
14. **तद्**
15. **एतद्**
16. **इदम्**
17. **किम्**

2. धातुरूपाणि (Present tense, Past tense and Future tense) परस्मैपद-आत्मनेपदधातवः

1.**भू धातुः**
2. **पठ् धातुः**
3. **गम् धातुः**

Text Books -

1. Samskrita Siksha - Part I & II Published by Department of Sanskrit and Indian culture, SCSVMV University (Deemed University), Enathur, Kanchipuram.

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
I	I	BCHF181TH0	Hindi –I	3	-	1	3

Aim:

- *To introduce the students to Hindi language and its correct form and to attract them towards. The beauty of Hindi.*

Objective:

- *To develop communication skills and writing skills in Hindi for the students belong to Non- Hindi speaking areas.*
- *To create opportunities to the students to enter into job filed of Central Govt. Offices through Hindi*.

***Outcome*:**

- *Have good communication skills*
- *Have writing and reading skills*
- *Deal with the situations where they need in switch on to different languages.*
- *To avail opportunities in job field.*

Unit –I (12 Hrs)

INTRODUCTION TO HINDI SCRIPT AND SPELLINGS:

a) Vowels
b) Consonants
c) Often wrong spelt words- corrections

Unit – II (12 Hrs)

BASICS OF HINDI VOCABULORY

a) Greeting words and introductory words
b) Words for daily usage and spoken purpose
c) Names, Counting of Numbers, colors, Vegetables, Flowers, Fruits and time calculation

Unit – III (12 Hrs)

INTRODUCTION TO HINDI GRAMMAR

a) Parts of speech
b) Gender
c) Number
d) Synonyms
e) Antonyms

Unit – IV (12 Hrs)

INTRODUCTION TO HINDI LANGUAGE WRITING

a) Application of case-endings (karak)
b) Sentence formation
c) Changing the sentence according to the direction

Unit – V (12 Hrs)

a) Usage of Tenses
b) Change of Tenses
c) Writing the sentence with the help of verbs
d) Transcription of paragraph
e) spoken Hindi practice

Text Book

1. Material prepared by Department of Hindi, SCSVMV.

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
I	II	BCHF181T20	English –I	3	-	1	3

Aim:

- *To develop the vocabulary of the students by introducing literary pieces. This is in conformity with the dictum that language is and can be through literature.*

Objective

- *To cultivate values to face challenges in life*
- *To broaden the vocabulary to develop the language*
- *To interpret and appreciate Literature*
- *To learn the basic of Grammar*.

Outcome:

The students are expected to be held to

- *Appreciate Literature*
- *Attain enhanced vocabulary*
- *Basics of English Grammar*
- *Attain ethical and moral values in life*

.

Unit I: Characters from Ramayana (12 Hrs)

1. Sri Rama
2. Sita Devi
3. Lakshmana

Unit II: Characters from Ramayana (12 Hrs)

4. Bharata
5. Dasaratha
6. Tolerance

Unit III: Vocabulary from the Essays (12 Hrs)

Unit IV: Basic Grammar (12 Hrs)

1. Articles
2. Pronouns –Personal & Impersonal
3. Adjectives
4. Synonyms & Antonyms
5. Sentence Structure

Unit V: Communication through Grammar (12 Hrs)

6. Tense forms
7. Idioms &Phrases
8. Suitability & Verbs
9. E-Mail
10. Patterns of Greeting

Book prescribed:

Sivananda, Sri Swami. *Essence of Ramayana*. Rikhikesh: The Sivananda Publication League, 1943

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
I	III	BCHF181T30	General Chemistry – I	4	0	1	5

Aim: *To study the basics of chemistry*

Objectives

- *To learn the basics of atomic structure, chemical bonding and periodic classification of elements.*
- *To understand the chemistry of Benzene and Benzenoid compounds.*
- *To understand the properties of gaseous molecules.*

Outcome

- *The students are expected to gain knowledge about periodic table, quantum chemistry and aromatic compounds.*

Unit I: Electron occupancy and periodic properties (15 hrs)

Electron Occupancy Quantum numbers - Principal, azimuthal, magnetic and spin Quantum numbers - their significance-Principles governing the occupancy of electrons- Aufbau Principle-Hund's rule -Pauli's exclusion principle, (n+l) rule, stability of half-filled and fully filled orbitals-Classification as s, p, d & f block elements, variation of atomic volume, atomic and ionic radii, ionisation potential, electron affinity and electro negativity along periods and groups – Variation of metallic characters - Factors influencing the periodic properties.

Unit II: Chemical Bonding (15 hrs)

Ionic bond - Lattice Energy - Born - Haber Cycle - Pauling and Muliken's Scales of electro negativity - Polarizing power and Polarisability - partial ionic character from electro negativity - Transitions from ionic to covalent character and vice versa - Fajan's rule. Theories of Bonding-Shapes of simple inorganic molecules based on VSEPR theory ($BeCl_2$, $SiCl_4$, PCl_5, SF_6, IF_7, NH_3, XeF_6, BF_3, H_2O) - VB Theory - Principles of hybridization - structure of $BeCl_2$, NH_3, H_2O – Basics of MO Theory -Bonding and antibonding orbitals - Application of MO Theory to H_2, He_2, N_2, O_2, HF and CO - Comparison of VB and MO Theories -H - bonding-types.

Unit III: Covalent bonding and Structure (15 hrs)

Covalent Bonding: Catenation- Concept of Hybridization-Types of hybridization & Structures-VBT and MOT concepts.

Electronic Effects: Inductive, mesomeric, electromeric, resonance and hyperconjugative effects. Steric effect. Effect on the properties and reactivities of organic compounds.

Reactive Intermediates: Structure and Stability-Types of organic reactions - General concept of reactions. Substrate-Intermediate-TS energy profile diagram (Basic treatment) - Nomenclature of organic compounds.

Unit IV: Chemistry of Benzene and other benzenoid compounds (15 hrs)

General methods of preparation of benzene – Chemical properties – Uses – Electrophillic substitution mechanism – Orientation and reactivity in substituted benzenes. Types of Polynuclear Aromatic compounds –Chemistry of Naphthalene, Anthracene, Phenanthrene and their uses.

Unit V: Gaseous state (15 hrs)

Maxwell's distribution of Molecular velocities (Derivation not required). Types of Molecular velocities – Mean, Most probable and root mean square velocities. Graphical representation and its significance – Collision diameter, Mean free path and collision number – Transport properties – Thermal conductivity, Viscosity and Diffusion – Law of equipartition of energies – Degree of freedom. Molecular basis of Heat capacity – Real gases – van der Waal's equation of states – derivation – significance of critical constants – Virial equations of state – Law of corresponding states – Compressibility factor.

Text Books:

1. Puri B.R..,Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., (1993)
2. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997)
3. Puri B.R..,Sharma L.R., Pathania M.S.,Principles of Physical Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., (1993)

Reference Books:

1. Lee J.D.,Concise Inorganic Chemistry, UK, Black well science (2006)
2. Glasstone S., Lewis D.,Elements of Physical Chemistry, London, Mac Millan & Co. Ltd. (1976)
3. Morrison R.T. and Boyd R.N.,Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., (1976)
4. Frank J. Welcher and Richard B. Hahn, Semi micro Qualitative Analysis, New Delhi, Affiliated East-west Press pvt.Ltd.(1969)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
I	III	BCHF181T40	Principles of Environmental Science	3	-	1	4

Aim:

- *To understand about our environment.*

Objectives:

- *To familiarize the students with basic concepts of environment and creating awareness.*
- *To understand their role and responsibility of an individual in the environmental conservation.*

Outcome:

- *Students are expected to be aware about the environment and pollution problems.*

Unit - 1: Introduction to environment and environmental studies (12 Hrs)

Introduction to environment – components – nature of environment - need of awareness – water crisis - climatic change - fossil fuels– pollution – loss of biodiversity – deforestation – their impacts - reasons for environmental problems – anthropocentric and eco centric views.

Environmental studies - multidisciplinary nature – scope and aim – sustainable development- principles – RRR concept- extension – response of world community – Indian environmental movements – environmental calendar.

Unit – 2: Ecosystem and Biodiversity (12 Hrs)

Ecosystem – structure – functions – simplified ecosystem models (food chain and food webs and their types) - forest – grassland – pond – desert- estuary ecosystems – ecological succession - ecological pyramids – Bio-geochemical cycles of water – oxygen-carbon-phosphorous and sulphur.

Biodiversity – definition – types – species – genetic and ecosystem diversities- values of biodiversity – threats to biodiversity – conservation of biodiversity – endemism – biodiversity hotspots – Indian biodiversity – soils of India – floristic regions – endemic species of India – IUCN lists -red-green and blue data books.

Unit – 3: Natural resources (12 Hrs)

Natural resources – definition – types – forest resources – uses –deforestation- reasons - effects – water resources – distribution of water in the globe – other reasons for problems – conservation of water – dams – effects of dams - food resources – modern agriculture– ill effects -energy resources- types – hydel – nuclear – solar –wind and biomass energy - world scenario – Indian scenario

Population and environment – reasons for over exploitation of resources – population – demography – population curves – population explosion – effects – consumerism – effects – urbanization – reasons and effects- role of an individual.

Unit – 4: Environmental Pollution (12 Hrs)

Pollution – definition – types – air pollution – causes and effects – effects of CO_2 – CO – NOx –SOx – particulates – control of air pollution – water pollution – causes – effects – remedies – soil pollution – solid waste management – e waste – ill effects of e-waste – proper recycling- Noise pollution – reasons – effects – control – nuclear pollution – cases – effects and control – marine and thermal pollution causes – effects and remedies

Legal provisions for protecting environment – article 48 A – 51 A (g) – Environment act 1986 – Air act 1981 – Water act 1974 – wild life protection act – Forest act 1980- salient features and inadequacies - problems in implementation – reasons.

Unit – 5 : Social issues and environmental ethics (12 Hrs)

Present environmental scenario – green house effect – climate change – The Kyoto Protocol – ozone layer depletion-The Montreal Protocol - acid rain – causes – effects - disparity among the nations – The Copenhagen UNFCCC summit – carbon currency- virtual water- genetically modified organisms.

Environmental ethics – introduction – people getting affected - resettlement and rehabilitation – issues involved — Sardhar Sarovar project – Tawa Matsya sang - Melting icebergs of Arctic.

Text Book

1. Perspectives in Environmental studies – Anubha kaushik and CP kaushik, New age international publishers, 4th edition, 2014.

Reference books

1. Environmental Studies, N. Nandini, N. Sunitha and Sucharita Tandon,Sapna Book House, 2007.
2. Text book of Environmental Science, Ragavan Nambiar, Scitech Publications, 2009.
3. Text book of Environmental Chemistry and Pollution Control, S.S.Dara, S.Chand and Co., 2002.
4. Environmental Chemistry, Colin Baird, W.H.Freeman and company, New York,1999.
5. Environmental Chemistry, Gary W. Van Loon and Stephen J. Duffy, Oxford University Press, 2000.
6. New Trends in Green Chemistry, V.K. Ahluwalia and M. Kidwai, Anamaya Publishers, 2006.

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
I	III	BCHF181T50	Applied Physics-I	3	-	1	3

Aim:

- *To make students to get familiar with broad modules of Physics such as Elastic property, Optical fibers and ultrasonic waves.*

Objectives:

- *To impart knowledge to the students in the following areas;*
- *Elastic property, elastic behaviour of materials under strained conditions and various factors that affect elastic property.*
- *Various factors that affect acoustics of a building and principles of good acoustical designing of auditoriums.*
- *Production and application of Ultrasonic waves.*
- *Principle of laser emission, various lasers – designing and applications.*
- *Optical fibers, principle of light transmission and types of fibers, Zener diode, FET and JFET.*

Outcome:

- *At the end of the course, the student might have acquired knowledge in the following topics;*
- *Elastic nature of materials and their behaviour under stress along with factors that tend to decrease the elastic property .*
- *Requirement of good acoustics in building, remedies to be carried out against various factors that affect acoustics of a buildingand designing of auditoriums with good acoustics. Generations of Ultrasonic waves and applications.*
- *Principle of laser emission, various lasers – designing and applications. Optical fibers, principle of light transmission and types of fibers,Zener diode, FET and JFET.*

Unit I – Properties Of Matter

Elasticity - Stress – Strain – Hooke's law –Moduli of elasticity- Poisson's ratio- Elastic Behaviour of Material – Factors affecting Elasticity – Young's modulus by cantilever-Non - uniform Bending.

Unit II – Technical Acoustics

Reverberation time - Acoustics of buildings – Reverberation, echo, creep, focusing, standing wave, Principles to be observed in the Acoustical design of an Auditorium – Noise Pollution – Absorption coefficient - Ultrasonics -Generation – Piezoelectric method – Applications of Ultrasonics in industries.

Unit III – Laser

Principles – Einstein theory of spontaneous and stimulated emission – Population inversion - Nd:YAG laser , Co_2 laser – Applications of Lasers in 3D profiling, computer peripherals such as CD-ROM.

UNIT IV Fiber Optics

Types of Optical Fibers – step index – grated index single mode – multiple mode fiber – acceptance angle – Numerical aperture – applications in engineering and medicine.

UNIT V Electronics

P-N Junction and P-N Junction Diode - Zener Diode – V-I Characteristics –Zener diode as Peak Clipper- Field Effect Transisters (FET) –Types – Junction Field Effect Transistor (JFET)– Static and Transfer Characteristics.

Text Books

1. Applied Physics for Engineers – Venkatramanan, Raja, Sundarrajan –SCITECH Publishers – 2011.
2. Applied Engineering Physics – Rajendran&Marikani – Tata McGraw Hill Publications -
3. Modern Engineering Physics – R.K.Gaur&S.L.Gupta – DhanpatRai Publications -2011.
4. Modern Engineering Physics – A.S.Vasudeva – S.Chand& Company Ltd 1999.
5. Engineering Physics – Bhatacharya, Bhaskaran – Oxford Publications 2010.
6. Engineering Physics – B.N.Shankar& S.O.Pillai – New Age International Publishers.
7. Basic Electronics (Solid State) – B.L Thereja 2007.

Reference Books

1. Properties of Matter - D.S.Mathur. (Unit I) – 2008.
2. Sound - Brijilal& Subramanian. (Unit II) – 1985.
3. Engineering Physics - Rubhan Kumar. (Unit II & III)
4. Engineering Physics - M.N.Avadhanulu. (Unit II &III) – 1992.
5. Fiber Optics - R.Agarwal. (Unit IV)
6. Basic Electronics (Solid State) – B.L Thereja (Unit V) – 2007.

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
I	IV	BCHF181T80	Functional English	1	-	-	1

Aim:

- *Aims to promote graduates into employees.*

Objective:

- *To help students to develop their communication skills.*

Outcome:

The students are expected to be able to

- *Speak fluently in the classroom*
- *Listen and communicate efficiently*

Unit I (5 Hrs)

Interpersonal Communication:

i. At the Post –Office
ii. At the Doctor's
iii. At the Market
iv. At the Railway Station
v. At the Bank

Unit II (5 Hrs)

Speaking Skills:

i. Introducing oneself and others
ii. Giving Instructions
iii. Making Requests and Responding to Requests
iv. Apologsing and Responding to an Apology
v. Paying Compliments, Showing Appreciation and offering Encouragement

Unit III (5 Hrs)

Speaking Skills:

i. Asking for and Giving an Opinion
ii. Expressing Likes, Dislikes, Hopes, Wishes, Regrets
iii. Expressing Sympathy, Emotions and offering Condolences
iv. Expressing Possibility, Impossibility, Probability and Improbability
v. Expressing Ability and Inability, Obligation and Necessity

Reference Books :

1. Spoken English – Namrata Palta, 2nd edition, Tata Mcgraw –Hills, 2008.
2. Spoken English – Sasikumar and Dhamija
3. Conquest of Communication Vol. I & II – Dr T.M.Farhathullah

Semester II

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
II	I	BCHF182TT0	Tamil -II	3	-	1	3

நோக்கம் *தமிழில் பிரபந்தங்கள் எனப்படும் சிற்றிலக்கியங்கள் பற்றிய செய்திகளையும், சிறப்புகளையும் அறிய வகைமை மட்டும் காட்டப்பட்டுள்ளன. சமய இலக்கிய வகையில் கிருத்துவர்களின் தமிழ்த்தொண்டு குறிப்பிடப்பட்டுள்ளது. குறிப்புகள் அறியும் வகையில் இலக்கணம்; மொழிப்பயிற்சி காட்டப்பட்டுள்ளது.*

பயன் : *இலக்கிய வளம் மிகுந்த மொழி 'தமிழ்' என்பதை உணர்தல்; நூறு வகைக்கும் மேற்பட்ட சிற்றிலக்கியங்கள் தமிழில் உள்ளன என்பதறிந்து தமிழின் ஆழ, அகலம் உணர்தல்; சமயங்கள் வளர்த்த தமிழ் பற்றி அறிதல் மொழி இலக்கணத்தின் தொடக்க நிலை பற்றி புரிந்துகொள்ளல்.*

அலகு – 1 (12 hrs)

தமிழ் இலக்கிய வரலாறு ஹ

1. கிருத்துவ இலக்கிய வரலாறு
2. காப்பிய இலக்கிய வரலாறு

அலகு – 2 (12 hrs)

1. நந்திக் கலம்பகம்
2. முத்தொள்ளாயிரம்
3. தமிழ் விடு தூது

அலகு – 3 (12 hrs)

1. திருக்குற்றாலக் குறவஞ்சி (குறத்தி மலைவளம் கூறுதல்)
2. முக்கூடல் பள்ளு (நாட்டு வளம்)
3. இயேசு பிரான் பிள்ளைத் தமிழ் (செங்கீரைப் பருவம் முதல் 5 செய்யுள்கள்)

அலகு – 4 (12 hrs)

1. நளவெண்பா (கலி நீங்கு காண்டம்)

அலகு – 5 (12 hrs)

மொழிப் பயிற்சிஹ

1. இலக்கண குறிப்புகள்ஹ
   பண்புத்தொகை, வினைத்தொகை,
   உம்மைத் தொகை, அன்மொழித் தொகை,
   இருபெயரொட்டுப் பண்புத்தொகை
2. ஒரு பொருள் குறித்த பல சொற்கள்
3. பல பொருள் குறித்த ஒரு சொல்
4. அகர வரிசைப்படுத்துதல்

பார்வை நூல்கள்:

1. தமிழிலக்கிய வரலாறு – முனைவர். மு.வ., பாரி நிலையம், சென்னை.
2. தமிழிலக்கிய வரலாறு – ஜெ. ஸ்ரீசந்திரன், தமிழ் நிலையம், சென்னை.
3. தமிழ் சிற்றிலக்கியங்கள் – நா. வீ. செயராமன்.

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
II	I	BCHF182TS0	Sanskrit - II	3	-	1	3

Aim:

- *To understand the value of Sanskrit.*

Objective:

- *The course is prepared with the collection of subhasistas from amient text which gives a brief knowledge about the nature of human being in connection to the culture and tradition of India. The Objective of the course is to give a chance to the student to get the moral values as reflected in ancient texts.*

Outcome

- *To realize the unit features of the Sanskrit language*
- *To throw a light to understand the cultural heritage of India through the language of Sanskrit.*

Unit - I भागः – क (12 hrs)

Poetry: **सुभाषितमाला** I - 1 to 6 Slokas

Prose: Lessons 1 to 3 (From Sanskrit Pravesika)

Unit - II भागः – ख (12 hrs)

Poetry: **सुभाषितमाला** II - 1 to 8 Slokas

Prose: Lessons 4 to 6 (From Sanskrit Pravesika)

Unit - III भागः – ग (12 hrs)

Grammar:

1.**अच्सन्धिः**

2.**हल्सन्धिः**

Unit - IV भागः – घ (12 hrs)

Essays :

1.**अस्माकं देशः**

2.**दीपावली महोत्सवः**

3.**संस्कृतप्रचारस्य आवश्यकता**

Unit - V भागः – ङ (12 hrs)

Slokas (Verses) :

1. Sowndaryalahari (10 Slokas)

Text books

1. Subhashitamala, Prepared by Dept. of Sanskrit and Indian Culture, SCSVMV University.
2. Sowndaryalahari

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
II	I	BCHF182TH0	Hindi -II	3	-	1	3

Aim:

- *To introduce the students to Hindi language and its correct form and to attract them towards. The beauty of Hindi.*

Objective:

- *To develop communication skills and writing skills in Hindi for the students belong to Non- Hindi speaking areas.*
- *To create opportunities to the students to enter into job filed of Central Govt. Offices through Hindi.*

Outcome:

- *Have good communication skills*
- *Have writing and reading skills*
- *Deal with the situations where they need in switch on to different languages.*
- *To avail opportunities in job field.*

Unit –I (12 hrs)

PARAGRAPH AND PRECISE WRITING IN HINDI:

a) Comprehensive paragraph
b) Paragraph Writing
c) Simple translation of sentences

Unit – II (12 hrs)

HINDI LITERATURE – OLD POETRY

a) Tulasi Das
b) Rahim

Unit – III (12 hrs)

HINDI LITERATURE – MODERN POETRY

a) Himadri se
b) Bharat Mata

Unit – IV (12 hrs)

HINDI LITERATURE- PROSE

a) Smriti

Unit – V (12 hrs)

HINDI LITERATURE- PROSE

a) Sanyasi

Text Books:

1. 'SARAL HINDI SIKSHA' -1 (Prepared by Department of Hindi, SCSVMV)
2. 'HINDI SAHITYA SUDHA' (Edited by Department of Hindi, SCSVMV)

Reference Book

1. Saral Hindi Vyakanam- S.C. Kapoor (2009)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
II	II	BCHF182T20	English -II	3	-	1	3

Aim:

- *To develop the communication skills of the students through literature.*

Objective

- *To develop interest to appreciate literature*
- *To strengthen the aesthetic sense*
- *To inculcate moral values through stories*
- *To enrich vocabulary*

Outcome:

The students are expected to be able to

- *Appreciate Literature*
- *Developed aesthetic sense*
- *Enriched vocabulary*
- *Attain highest moral values*

Unit I: Stories from the Mahabharata (12 Hrs)

1. Wilderness of Life
2. The Cat and the Mouse
3. The Salmali Tree

Unit II: One Act Play (12 Hrs)

Urubhangam - Bhasa

Unit III: Vocabulary (12 Hrs)

Unit IV: Grammar I (12 Hrs)

1. Relative pronouns
2. Adverbs
3. Prepositions
4. Phrasal verbs
5. Idioms

Unit V: Grammar II (12 Hrs)

6. Active Voice & Passive Voice
7. Infinitives & Gerunds
8. Conditionals
9. Collocations
10. American and British words

Book prescribed:

Sivananda, Sri Swami. *Stories from the Mahabharata*. Tehri-Garhwal, Himalayas: The Divine Life Society, 1984.

Bhasa. *Urubhangam: One Act Play*. Samskrita Sahitya Sadana, 1967

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
II	III	BCHF182T30	General Chemistry- II	4	-	1	5

Aim: *To study the basic concepts of chemistry*

Objectives

- *To learn the basics of Qualitative analysis, solid state and colloids.*
- *To understand the chemistry of organic halogen compounds and phenols.*
- *To understand the basics of chemical kinetics and catalysis.*

Outcome

- *The students are expected to gain knowledge about Qualitative analysis, chemical kinetics and catalysis.*

Unit I: Principles of wet chemical analysis (15 hrs)

Qualitative Analysis: Solubility Product Principle- Factors affecting solubility- temperature, solvent common ion effect- effect of complex formation. - Spot test- interfering cations – reason for interference and method of removal.

Titrimetry: Definitions of Molarity normality, Molarity and mole fraction – Primary and Secondary standards – Types of titrimetric reactions – acid-base, redox, precipitation and complexometric titrations – Indicators – Effect of change in p^H – Theories of Neutralization, redox, adsorption and metal ion indicators.

Unit II: Organohalogen Compounds (15 hrs)

Nomenclature – general methods of preparation of haloalkanes – physical and chemical properties – nucleophillic substitution mechanisms (S_N1, S_N2 and S_Ni) – evidences – stereochemical aspects of nucleophillic substitution mechanisms – Elimination reactions (E_1 and E_2) – Hoffmann Saytzeff rule-general methods of preparation of benzyl chloride – physical and chemical properties.

Unit III: Chemistry of Phenols and Ethers (15 hrs)

Preparation of phenols including di and tri hydric phenols – physical and chemical properties – uses –derivatives of phenol (aspirin, methyl salicylate, salol) - laboratory preparation of ethers, epoxides – 1,4 dioxane - physical and chemical properties – uses.

Unit IV: Solid state and Colloids (15 hrs)

Classification of solids – Laws of crystallography – representation of planes – Miller indices, space lattice, crystal systems – seven primitive, unit cells – X -ray diffraction – derivation of Bragg's equation – determination of structure of NaCl by Debye Scherrer (powder method) and rotating crystal method-Colloids-definition-classification – general methods of preparation (double decomposition, Mechanical dispersion methods only)–Purification-Mechanical, optical and electrical Properties of colloids –coagulation-peptization - gold number – applications of colloids.

Unit V: Chemical Kinetics and Catalysis (15 hrs)

Rate of reaction, average and instantaneous rates, rate equation, order of reaction. Rate laws: rate constants – derivation of rate constants and characteristics for zero, first and second order (equal initial concentration) – derivation of half life period.

Methods of determination of order of reactions – half life period and graphical method – experimental methods of determination of rate constant of a reaction – volumetry, manometry, polarimetry.

Effect of temperature on reaction rate - concept of activation energy, energy barrier, Arrhenius equation. Theories of reaction rates - collision theory - derivation of rate constant of bimolecular gases reaction - failure of collision theory – Lindemann's treatment- Theory of absolute reaction rates.

Catalysis –Introduction, types and Examples.

Text Books:

1. Puri B.R..,Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., (1993)
2. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997)
3. Puri B.R..,Sharma L.R., Pathania M.S.,Principles of Physical Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., (1993)

Reference Books:

1. Lee J.D.,Concise Inorganic Chemistry, UK, Black well science (2006)
2. Glasstone S., Lewis D.,Elements of Physical Chemistry, London, Mac Millan & Co. Ltd. (1976)
3. Morrison R.T. and Boyd R.N.,Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., (1976)
4. Frank J. Welcher and Richard B. Hahn, Semi micro Qualitative Analysis, New Delhi, Affiliated East-west Press pvt.Ltd.(1969)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
II	III	BCHF182T40	Applied Physics - II	3	-	1	3

Aim:

- *To make students to get familiar with broad modules of Physics such as Nano Physics, Magnetism & Dielectrics, Engineering Materials , Optoelectronic Devices, Integrated Circuits & Logic Gates*

O*bjectives:*

- *To impart knowledge to the students in the following areas;*
- *Basics nanoparticles, properties, synthesis and applications, Magnetic materials, properties and applications, Dielectric materials and their applications, basic ideas of metallic glasses, shape memory alloys and biomaterials and their applications, superconductivity, superconductors, their types and applications.*
- *Working principle and applications of LED, PMT, LCD, PN junction and Photo conductive cells.*
- *Introduction to ICs and various logic gate, IC fabrication and various logic operations.*

Outcome:

- *At the end of the course, the student might have acquired knowledge in the following topics;*
- *Nanoparticles, their size range, properties, synthesis and applications, Dia,Para and Ferro magnetic materials, properties and applications, Dielectric materials and their applications, Nature of metallic glasses, fabrication, shape memory alloys, biomaterials and their applications, occurance of superconductivity, transition temperature, type I and II superconductors, and applications. Construction and working of LED, PMT, LCD, PN junction and Photo conductive cells. ICs and their fabrication processes ,various logic gates and various logic operations.*

Unit I – Nano Physics

Introduction to Nano materials - Quantum confinement – Properties of nano materials – Synthesis of nano materials – Top down and bottom up approach – Ball milling and Physical vapour deposition method – applications of nano materials – CNTs.

UNIT II - Magnetism & Dielectrics

Types of Magnetic materials(Dia,Para and Ferro)– properties – Application- Floppy Disc

Dielectrics- Basic Definitions –Dielectric Breakdown – Dielectric loss – Internal field – Classius-Mossotti relation. Application of Dielectric materials

UNIT III - Engineering Materials

Introduction and Properties of Metallic glasses – Shape memory alloys – Bio materials Superconductors-Introduction – Meissner effect – Type I & Type II superconductors – High Tc Superconductors

UNIT IV- Optoelectronic Devices

Photomultiplier Tube –Photo Conductive cells – P-N junction Photodiode – PIN Photodiode- Avalanche Photodiodes - Light Emitting Diode (LED) –-Liquid Crystal Display(LCD)

UNIT V - Integrated Circuits & Logic Gates

Introduction –Scale of Integration-Classification of IC's by Structure and function – Linear and Digital Integrated Circuits- Fabrication of IC Components – Logic Gates- Positive and Negative Logic- The OR, AND, NOT Gates – Symbols and Truth table for Logic Operations – Universal Gates – The NAND & NOR gates – Symbols and Truth Table for Logic operations

Text Books

1. Applied Engineering Physics – Rajendran&Marikani – Tata McGraw Hill
2. Modern Engineering Physics – R.K.Gaur&S.L.Gupta – DhanpatRai publications- 2011.
3. Modern Engineering Physics – A.S.Vasudeva – S.Chand& Company Ltd. -1999.
4. Engineering Physics – Bhatacharya, Bhaskaran – Oxford Publications 2010.
5. Engineering Physics – B.N.Shankar&S.O.Pillai – New Age International
6. Applied Physics for Engineers – Venkatramanan, Raja, Sundarrajan –SCITECH - 2011
7. Basic Electronics (Solid State) – B.L Thereja– 2007.

Reference Books

1. Modern Physics - R.Murugesan. (Unit I) – 2011.
2. Engineering Physics - Rubhan Kumar. (Unit II) -
3. Engineering Physics - M.N.Avadhanulu. (Unit II&III) - 1992.
4. Engineering Physics – P.K.Palanisamy - Scitech Publications (Unit II &III) – 2009.
5. Basic Electronics (Solid State) – B.L Thereja (Unit IV & V) – 2007.

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
II	III	BCHF182T50	Programming in C	3	-	1	4

Aim:

- *Introduce the students to get the programming skills of 'C' language via mathematical functions.*

Objective:

- *To gain experience about structured programming*
- *To help the students to understand the implementation of C language*
- *To understand various features in C.*

Outcome:

After completion of the course,

1. *Have knowledge on programming skills of 'C' language.*
2. *Deal with problem which may arrive in mathematics*
3. *Prepare for software companies, involving placement opportunities*.

Unit – I (12 hrs)

Introduction – Importance of C language – Basic structure of C program – Constants – Variables – Data types – Declaration of Variables – Assigning values to Variables. Operators and Expressions: Introduction – Types of Operators – Arithmetic expressions – Evaluations of expressions – Precedence of arithmetic operators – Type conversions in expressions.

Unit – II (12 hrs)

Decision making and Branching: if, simple if, IF ELSE, Nesting of IF-ELSE, ELSE-IF ladder, SWITCH statement, the ?: operator, GO operator, goto statement. Decision making and looping: while, do, for statement, jumps in loops.

Unit – III (12 hrs)

Arrays: Introduction – One dimensional array – Two dimensional arrays – initializing Two dimensional arrays – Multi dimensional arrays.

Functions: User defined functions: Introduction – Need for user defined functions – Return values and their return types – Calling a function – Category of functions – Nesting of functions – Recursion function.

Unit – IV (12 hrs)

Pointers: Introduction – Accessing the address of the variable – Declaring and initializing Pointers – Accessing through its Pointers – Pointer expression, increments and scaling factor – Pointer and Arrays – Pointer and Character strings – Pointer and Function – Pointer and Structures – Pointer on Pointers.

Unit – V (12 hrs)

Structures and Unions: Introduction – Structure definition – Giving value to members – Structure initialization – Comparison of Structures – Structures and Functions – Size of Structures – Unions. File handling: Defining and Opening a File – Closing a File – input/output operations on Files.

Text Book:

1. E. Balaguruswamy - "Programming in ANSI C', Tata McGraw Hill Publishing Company, sixth edition BPB publication 2005.

Reference Book:

1. Herbert Schildt, The complete reference, Mcgraw – Hill, 1998.
2. Byron C Gotfried, Programming with C, Schuams outline series, 2nd edition Tata McGraw Hill 2006.
3. The spirit of C, An introduction to modern programming, by henry Mullish, Herbert cooper, west pub.co. ,1987.

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
II	III	BCHF182P70	Major Practical- I	-	5	-	5

MAJOR PRACTICAL – I- VOLUMETRIC ANALYSIS

I Titrimetric Quantitative Analysis

1. Estimation of HCl by NaOH using a standard oxalic acid solution
2. Estimation of Na_2CO_3 by HCl using a standard Na_2CO_3 solution
3. Estimation of oxalic acid by $KMnO_4$ using a standard oxalic acid solution
4. Estimation of Iron (II) sulphate by $KMnO_4$ using a standard Mohr's salt solution.
5. Estimation of Ca (II) by $KMnO_4$ using a standard oxalic acid solution.
6. Estimation of $KMnO_4$ by thio using a standard $K_2Cr_2O_7$ solution.
7. Estimation of Fe (III) by using $K_2Cr_2O_7$ using a standard Mohr's salt solution using internal and external indicators.
8. Estimation of copper (II) sulphate by $K_2Cr_2O_7$solution
9. Estimation of Mg (II) by EDTA solution
10. Estimation of Total Hardness of water
11. Estimation of chlorine in Bleaching Powder
12. Estimation of saponification value of an oil

Reference:

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

Scheme of Valuation	
Record	**10 marks**
Procedure Writing	**20 marks**
Experiment	**30 marks**
Calculation	**20 marks**
Results < 2 % - 10 marks 3 % - 8 marks 4 % - 6 marks 5 % - 4 marks >5 % - 2 marks	**10 marks**
Viva	**10 marks**
Total	**100 marks**

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
II	III	BCHF182P80	Allied Physics Laboratory	-	3	-	2

(ANY 10 EXPERIMENTS ONLY)

1. Acceleration due to gravity-Compound pendulum method
2. Moment of inertia – Torsional pendulum method
3. Young's modulus - Uniform bending - Optic lever method
4. Young's modulus - Non-uniform bending - Pin and microscope
5. Rigidity modulus – Static torsion method.
6. Frequency of A.C - Sonometer
7. Thermal conductivity - Lee's disc method.
8. Refractive index of a solid prism - Spectrometer
9. Refractive index of a liquid prism – Spectrometer
10. (i-d) curve - solid prism - Spectrometer
11. Wavelengths of spectral lines – Grating - Normal incidence - Spectrometer
12. Wavelength of spectral lines – Grating - Minimum deviation - Spectrometer
13. Radius of curvature of lens - Newton's rings method.
14. Viscosity of highly viscous liquid - Stoke's method.
15. Surface tension - Drop weight method
16. Characteristics of Pn Junction diode
17. Characteristics of Zener diode
18. Verification of truth tables of logic gates.

Reference Book:

1. Engineering Physics Lab Manual – By Dr. K. Venkatramanan et al., SCSVMV, (2013)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
II	IV	BCHF182T60	Indian Culture	1	-	-	1

Aim:

- *To create an opportunity to understand the value of human life.*

Objective:

- *This paper aims to provide awareness of the duties and responsibilities of human which framed by the early Sindh Vedic societies, is essential to passed on from one generation to the other, for the welfare of societies and to understand the significance of various social events. Ancient Indians made considerable scientific progress in the fields of science and technology. This paper also provides to draw linkages between modern science and rich Indian scientific advanced thoughts and applications.*

Outcome:

- *To know the duties and responsibilities of the human life.*
- *To get an idea about the samskaras*
- *To highlight the scientific aspects through literature.*

Unit I (3 Hrs)

Duties & responsibilities of human; *gruhya sutras*, *smrities* & *sruties* – *significance* in day-to-day life.

Unit II (3 Hrs)

Samskaras or Sacraments – Important occasions & significance; Sixteen important *Samskaras* in due course of human life. Responsibilities of Human - four *Ashrama Dharmas*.

Unit III (3 Hrs)

Significance of social gatherings & celebrations of different occasions. Worship – personal and public rituals & their significance; soi-cultural significance of festivals and impact on culture. Significance of Yoga in daily life.

Unit IV (3 Hrs)

Social significance of religion; evolution of religious thoughts and ritual practices; different philosophical Schools. structural evolution for ritual practices; significance of temples & other constructions. Civil engineering skill & construction technologies;

Unit V (3 Hrs)

Scientific thoughts of early Indians. Vedic Mathematics. Astrology & Astronomy. Scientific aspects in *Vastusastra*, etc. early Indian works and its importance in day-to-day life.

Reference Books

1. Jagadguru Swami Sri Bharati Krishna Tirthaji Maharaj. 1994 *Vedic Mathematics*. Motilal Banarasidas. New Delhi.
2. Joshi,K. 1992(rp). *The Veda and Indian Culture*. Rastriya Veda Vidya Pratishthana. New Delhi.
3. Kangle, R.P. 1992 (rp). *The Kautilya Arthasastra.* Delhi.
4. Kulkarni, R.P. 1983. *Geometry according to Sulba Sutra*. Samsodhana Mandal. Pune.
5. Majumdar, R.C. 1994 (rp). *Ancient India*. Motilal Banarsidas Publishers. Delhi.
6. Patel, I.S. (ed). 1984. *Science and the Vedas*. Bombay.
7. Majumdar, R.C. 1996 (ed) (rp). The History and Culture of the Indian People. Vol I-IV. Bharatriya Vidya Bhavan. Mumbai

Semester III

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
III	I	BCHF183TT0	Tamil –III	3	-	1	3

நோக்கம் : *தமிழின் சிறந்த அமைப்பான 'பக்தி இலக்கியம்' பற்றி உணர்வதற்காக சைவ, வைணவ இலக்கியப் பாடல்கள் தரப்பட்டுள்ளன. நீதி நூல் – திருக்குறளின் மேன்மை உணர 5 அதிகாரங்கள் தரப்பட்டுள்ளன. இலக்கிய வரலாறு பல்லவர் காலமும், உரைநடை சிறப்பு அறிய மு.வ. வின் கட்டுரைகளும், தமிழர் பண்பாடு பற்றி அறிதற்கான குறிப்புகளும் தரப்பட்டுள்ளன.*

பயன் : *அளவில் அதிகமான படைப்புகளை, பக்தி சார்ந்த படைப்புகளாகத் தமிழ் கொண்டுள்ளது என்பதுணர்தல் ;பக்திமொழி என்று தமிழ் அழைக்கப்படுவதை அறிதல் ; சைவ, வைணவ சமய நூல்களை அறிதல் ; பக்தி இயக்க காலத்தின் தொடக்கமான பல்லவர் கால இலக்கியங்களை அறிதல் ; தமிழர்களின் பண்பாடு பற்றிய சில செய்திகளைத் தெரிந்துகொள்ளல், அறிவுரை தரும் குறட்பா செய்திகளையும், மு.வ.வின் 'நல்வாழ்வு' பற்றிய செய்திகளையும் அறிதல்.*

1. செய்யுள்
2. மொழித்திறன்
3. இலக்கிய வரலாறு
4. உரைநடை
5. தமிழ்ப் பண்பாடு

அலகு – 1 செய்யுள் (12 hrs)
1. திருக்குறள் – ஐந்து அதிகாரங்கள்
2. சம்பந்தர் தேவாரப் பதிகம் ஒன்று மட்டும்
3. குலசேகர ஆழ்வாரின் பெருமாள் திருமொழி பாசுரப்பகுதி

அலகு – 2 மொழித்திறன் (12 hrs)
1. நேர்காணல்
2. கலைச்சொல்

அலகு – 3 இலக்கிய வரலாறு (12 hrs)
1. பல்லவர் கால இலக்கியங்களின் வரலாறு

அலகு – 4 உரைநடை (12 hrs)
1. மு.வ.வின். நல்வாழ்வு நூலில் 6 முதல் 10 தலைப்பு வரை

அலகு – 5 தமிழ்ப்பண்பாடு (12 hrs)
1. தமிழ்ப்பண்பாடு அறிமுகம் என்ற அளவில் சுமார் 45 பக்க அளவுள்ள செய்திகள்.

பார்வை நூல்கள் :

1. மொழித்திறன் – முனைவர். மு.வ., பாரி நிலையம், சென்னை.
2. நல்வாழ்வு – முனைவர். மு.வ., முல்லை நிலையம், சென்னை.
3. நல்ல தமிழ் எழுத வேண்டுமா? – அ. கி. பரந்தாமன், சென்னை.
4. தேவாரப் பதிகங்கள் – சண்முகம் பிள்ளை, நிரஞ்சன விலாச பதிகம், சென்னை.

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
III	I	BCHF183TS0	Sanskrit –III	3	-	1	3

Aim:

- *To understand the value of Sanskrit.*

Objective:

- *The Course offers a comprehensive knowledge about the mahabharat and Hitopadesa and to understand the moral values as reflected in the verse of mahabarata and in the story of the Hitopadesa.*

Outcome

- *To realize the unit features of the Sanskrit language*
- *To throw a light to understand the cultural heritage of India through the language of Sanskrit.*

Unit - I भागः – क (12 hrs)

Eloquence of Mahabharata 1-15 Verses

Unit - II भागः – ख (12 hrs)

Eloquence of Mahabharata 16-30 Verses

Unit - III भागः – ग (12 hrs)

Hitopadesa – Prologue Stories

1. Old Tiger and Traveller
2. Cat and Vulture

Unit - IV भागः – घ (12 hrs)

Hitopadesa –Stories

1. Pair of Crows
2. Pair of Tittibhas
3. Rabbits and Elephant

Unit - V **भागः – ङ** (12 hrs)

Hitopadesa –Stories

1. Jackal
2. Crane and Crab
3. Camel

Text Books:

1. Eloquence of Mahabharata, Prepared by Dept. of Sanskrit and Indian Culture, SCSVMV University.
2. Hitopadesa – Compiled by Dept of Sanskrit and Indian culture, SCSVMV University.

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
III	I	BCHF183TH0	Hindi –III	3	-	1	3

Aim:

To introduce the students to Hindi language and its correct form and to attract them towards. The beauty of Hindi.

Objective:

- *To develop communication skills and writing skills in Hindi for the students belong to Non- Hindi speaking areas.*
- *To create opportunities to the students to enter into job filed of Central Govt. Offices through Hindi.*

Outcome:

- *Have good communication skills*
- *Have writing and reading skills*
- *Deal with the situations where they need in switch on to different languages.*
- *To avail opportunities in job field.*

Unit –I (12 hrs)

Introduction To Vocabulary:

a) Sabd Rachana and Sabd Vichar
b) Prefix and Suffix practices
c) Correction of Sentences

Unit – II (12 hrs)

Hindi Literature – Old Poetry

a) Kabir
b) Mira Bai

Unit – III (12 hrs)

Hindi Literature – Modern Poetry

a) Vah Todti Patthar
b) Himalay ke Prati

Unit – IV (12 hrs)

Hindi Literature- Prose

a) Nayak ka chunav (Story)

Unit – V (12 hrs)

Hindi Literature- Prose

a) Main Narak se Bol raha hoon (Vyangya)

Text Books:

1. 'Saral Hindi Siksha' -1(Prepared by Department of Hindi, SCSVMV)
2. 'Hindi Sahitya Sudha'(Edited by Department of Hindi, SCSVMV)

Reference Books :

1. Saral Hindi Vyakarana – Shyam Chandra Kapoor (2009)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
III	II	BCHF183T20	English –III	3	-	1	3

Aim:

- *To equip the linguistic competencies of students by introducing poetry and to develop the writing skills of students.*

Objective:

- *To introduce other genres of Literature.*
- *To understand and appreciate poetry as a literary genre*
- *To improve vocabulary*
- *To develop essential competencies for successful life*
- *To kindle creative and innovative thoughts*

Outcome:

The students are expected to be able to

- *Understand other genres of Literature*
- *Appreciate the nuances of poetry*
- *Improved language skills*
- *Ability to communicate ideas logically*

UNIT I: Poetry **(12 hrs)**

Maitreem Bhajata: A Benediction - Maha Periyava
Universal Prayer - Swami Sivananda
Where the Mind is Without Fear - Rabindranath Tagore

UNIT II: Stories that foreground Indian Culture **(12 hrs)**

1. Truth at any cost
2. Character, not caste, makes for Superiority
3. Man, the master of his destiny

UNIT III: One Act Play **(12 hrs)**

Karnabharam - Bhasa

UNIT IV: Vocabulary **(12 hrs)**

UNIT V: Modes of Communication **(12 hrs)**

1. Writing
2. Degrees of Comparison
3. Factual Writing

Book Prescribed:

http://www.acharya.gen.in:8080/maitreem.php https://www.sivananda.eu/en/meditation/the-4-yoga-paths/universal-prayer.html

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
III	III	BCHF183T30	Analytical chemistry	4	-	1	5

Aim: *To learn about laboratory hygiene, safety and basic analytical chemistry techniques.*

Objective:

- *To learn the basic analytical methods and appreciate what is involved in an analysis.*
- *To understand the different types of basic analytical methods available.*

Outcome:

- *Understanding on laboratory hygiene, safety precautions*
- *Understanding on various analytical techniques available for chemical analysis and characterization.*

Unit I: Introduction to analytical chemistry (15 hrs)

Laboratory Hygiene and safety: Storage and handling of corrosive, flammable, explosive, toxic, carcinogenic and poisonous chemicals. Simple first aid procedures for accidents involving acids, alkalies, bromine, burns and cut by glass. Threshold vapour concentration - safe limits. Waste disposal and fume disposal.

Evaluation of analytical data: Mean, median and mode - Accuracy and precision – ways of expressing accuracy and precision -Errors - types -determinate, indeterminate and gross errors - minimization of errors - methods of reporting data - significant figures.

Unit II: Gravimetric analysis (15 hrs)

Gravimetric analysis - principle - theories of precipitation - solubility product and precipitation – conditions of precipitations-types of precipitants-specific and selective precipitants- organic and inorganic precipitants - types of precipitation - purity of precipitates – co- precipitation - post precipitation - precipitation from homogeneous solution - use of sequestering agents.

Unit III: Thermo analytical techniques (15 hrs)

Thermo analytical methods: Principle of thermo gravimetry, differential thermal analysis, differential scanning calorimetry - Instrumentation for TGA, DTA and DSC - Characteristics of TGA and DTA curves - factors affecting TGA and DTA curves. Applications - TGA of calcium oxalate monohydrate, DTA of calcium acetate monohydrate - determination of purity of pharmaceuticals by DSC.

Thermometric titration – principle and instrumentation – titration of HCl Vs NaOH – complexometric titration – applications.

Unit IV: Electro analytical Techniques (15 hrs)

Electro gravimetry –theory - electro gravimetric analysis of Fe and Cu, Electrolytic separation of metals: principle –separation of copper and nickel, Electro deposition- principle –overvoltage, Coulometry -Principle of coulometric analysis – coulometry at controlled potential- apparatus and technique-separation of nickel and cobalt. Amperometry titrations - principle –Instruments – types-applications.

Unit V: Chromatography techniques (15 hrs)

Chromatography – definition – types – principle, theory and applications of Column, Thin layer, paper, Ion-exchange, Gas and HPLC chromatographic techniques.

Text Books:

1. Goplan. R., Subramaniam P.S., Rengarajan K., Elements of Analytical Chemistry, sultan Chand & Sons., (2004)
2. Durbha Charan Dash, Analytical Chemistry, PHI Learning Pvt. Ltd., (2011)

Reference Books:

1. Sharma. B.K., Analytical Chemistry, Krishna Pragasan Media Pvt. Ltd., (2011)
2. Douglas A. Skoog, Donald M. West, F.J. Holler, Fundamental of Analytical Chemistry, Saunders College publishing, (1994)
3. Mendham J., Denney R.C., Barnes J.D., Thomas M., Vogel's Text Book of Qualitative Chemical Analysis, Pearson educations, (2000)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
III	III	BCHF183T4A	Allied Mathematics-I	3	-	1	4

Aim:

- *Introduce the students to the foundational aspects of matrices and their utility, expansion of trigonometric series, Numerical methods, successive differentiation and definite, indefinite integrals.*

Objective

- *To introduce the concepts of matrices and their utility*
- *To familiarize the concepts of expansion of series, numerical methods, successive differentiation and definite, indefinite integrals.*

Outcome:

After completion of the course the students are expected to be able to

- *Have the knowledge in matrices and their utility.*
- *Identification of different type of trigonometric series and to solve that series.*
- *To solve algebraic, transcendental and linear simultaneous equations using Numerical Methods.*
- *To solve successive differentiation using famous theorem.*
- *Have the basic knowledge in definite and indefinite integrals.*

Unit-I (12 Hrs)

Symmetric - Skew-Symmetric - Orthogonal and Unitary matrices - Rank of a matrix -Consistency of equations - Eigen roots and eigen vectors - Cayley- Hamilton theorem (without proof)-Verification and computation of inverse matrix

Unit-II (12 Hrs)

Expansions of sin x, cos x, tan x in terms of x ; sin nx, cos nx, tannx, $\sin^n x$, $\cos^n x$, $\tan^n x$, hyperbolic and inverse hyperbolic functions – Simple problems.

Unit-III (12 Hrs)

Solution of algebraic and transcendental equations-Bisection Method- Method of false position- Newton – Raphson method-Solution of linear simultaneous equations- Gauss elimination method- Gauss Jordon method-Gauss Seidal method

Unit-IV (12 Hrs)

Successive Differentiation- nth order derivatives of standard functions- Leibnitz theorem (without proof)-simple problems- Partial differentiation- Euler's theorem- Problems on Euler's theorem

Unit-V (12 Hrs)

Evaluation of definite and indefinite Integrals of types

1. $\int \frac{px+q}{ax^2+bx+c}dx$ 2. $\int \frac{px+q}{\sqrt{ax^2+bx+c}}dx$ 3. $\int \frac{1}{(px+q)\sqrt{ax^2+bx+c}}dx$

1. $\int \frac{1}{a+b\cos x}dx$ 5. $\int \frac{1}{a+b\sin x}dx$ 6. $\int \frac{a\cos x+b\sin x+c}{l\cos x+m\sin x+n}dx$

7. $\int_0^{\frac{\pi}{2}} \sin^n x dx$, $\int_0^{\frac{\pi}{2}} \cos^n x dx$

Reference books:

1. Trigonometry : P. Duraipandian (1984)
2. Matrices: A.R.Vasishtha , A.K.Vasishtha (1991)
3. Numerical Methods, Problems and Solutions: M.K.Jain, S.r.K Iyengar, R.K.Jain (2003)
4. Calculus. S.Narayanan and T.K.Manicavachagom Pillay (2004). S.Viswanathan Printers & Publishers Pvt. Ltd. Chennai.
5. Algebra and Trigonometry, Vol.-I & II, A.Singaravelu, Meenakshi Agency, Chennai. (2003)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
III	III	BCHF183T4B	Allied Computer Science-I	3	-	1	3

Aim:

- *To understand the concepts of object oriented programming and Master oops using C++*

Objective:

- *Develop application using object oriented programming*
- *Solving problems using object oriented approach*

Outcome:

- *Knowledge Enrichment*
- *Critical analysis where programming gaps are identified*
- *Problem solving*
- *Design and Implement using C++*

UNIT - I

Principles of Object Oriented Programming (OOP) - Software Evaluation - OOP Paradigm - Basic Concepts of OOP - Benefits of OOP - Application of OOP.

UNIT - II

Introduction to C++ - Tokens - Keywords - Identifiers - Variables - Operators - Manipulators - Expressions and Control Structures - Pointers - Functions - Function Prototyping - Parameters Passing in Functions - Values Return by Functions

UNIT - III

Classes - objects - this pointer - constructor - destructor - inline function - friend function - scope resolution operator – operator overloading and Type Conversations.

UNIT - IV

Inheritance - Types of Inheritance - Constructors in inheritance - virtual base classes - Virtual functions and Polymorphism - abstract classes - templates -generic functions - generic classes

UNIT - V

Files - I/O streams - manipulators - files - writing and retrieving objects from files.

REMARKS

"EACH UNIT IS TO BE COVERED IN 12 PERIODS EACH OF 50 MINUTES DURATION"

Total No of Periods : 60

TEXT BOOKS:

1. Programming in C++ : Balaguruswamy 5th Edition Tata Mcgraw Hill Education Private Limited (2011) .
2. C++: "How To Program" by Paul J.Deitel , Harvey M.Deitel, Prentice Hall, 2010

REFERENCE BOOKS:

1. Object Oriented programming Using C++ -by Robert Lafore. 'Waite's Group'.

2. The Complete Reference by Herbert Schildt.

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
III	IV	BCHF183T50	Chemistry in Everyday life	1	-	1	1

Aim: *To get the knowledge about the usage of chemicals.*

Objectives:

- *To know the basics of chemistry in our life*
- *To know about the food colours, Plastics, drugs etc*

Outcome:

- *To gain knowledge about the adulterants in food materials*
- *To study about chemicals*

Unit I : Cosmetics & Detergents (5 hrs)

General Survey of Chemicals used in everyday life.

Cosmetics: Talcum Powder, Tooth pastes, Shampoos, Nail Polish, Perfumes, Soaps, and detergents - General formulations and preparation - possible Hazards of cosmetics use.

Unit II: Food Preservation & Adulteration (5 hrs)

Adulterants in milk, ghee, oil, coffee powder, tea, asafoetida, chilli powder, pulses and turmeric powder - identification. Colour chemicals used in food - soft drinks and its health hazards.

Food preservatives-Definition-Examples-Methods of preservation-Low and high temperature-Dehydration.

Unit III: Polymeric Materials (5 hrs)

Plastics, polythene, PVC, bakelite, polyesters, resins, and their applications.

Natural Rubber-Synthetic rubbers-Vulcanization - definition and its applications.

Text Books:

1. Industrial Chemistry, B.K. Sharma- Goel publishing house Meerut. (2003)
2. Food Science - B. Srilakshmi - III Edition - New Age International Publishers. (2005)

Reference Books:

1. Chemical Process Industries - Norris Shreve Joseph A.Brine .Jr. (1977)
2. Environmental Chemistry - A .K. DE. (2003)
3. Food Chemistry Lillian Hoagland Meyer - CBS publishes & distributors (2004)
4. Fundamental concepts of Applied Chemistry - Jayashree Ghosh - S.Chand & Co Ltd., New Delhi. (2008)
5. Applied chemistry - K.Bagavathi Sundari - MJP Publishers. (2006)

Semester IV

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
IV	I	BCHF184TT0	Tamil -IV	3	-	1	3

நோக்கம் – *தமிழின் தொன்மை இலக்கியமான சங்ககாலத்தில் அகம், புறம் இலக்கியம் பற்றி அறிய குறுந்தொகை, புறநானூறு பாடல்கள் தரப்பட்டுள்ளன. காப்பியச் சிறப்புணர சிலம்பும், பெரியபுராணமும் உள்ளன. மொழி நூல் நோக்கில் தமிழின் பெயர், வினைச்சொல் பற்றியும், நாயக்கர் கால இலக்கியங்கள் பற்றிய குறிப்புகளும் பயிற்றுவிக்கப்படவுள்ளன.*

பயன் : *தமிழில் என்றென்றும் சிறந்த படைப்பாகத் திகழும் 'சங்க இலக்கியம்' பற்றி அறிதல் ; தமிழ்க் காப்பியங்கள் பற்றி அறிதல்; தமிழ்ச் சொல் இலக்கிணம், சொல் பற்றிய வகைமை, அமைப்பு பற்றி அறிதல் ; நாயக்கர் காலத்தில் தோன்றிய, சிறந்த இலக்கியநூல்களையும், உரையாசிரியர்கள் தமிழக்குச் செய்த தொண்டினையும் உணர்தல்.*

1. செய்யுள்
2. இலக்கணம்
3. இலக்கிய வரலாறு

அலகு – 1 செய்யுள் (12 Hrs)

1. குறுந்தொகை – 10 பாடல்கள்
   பா.எண்ஹ 02, 03, 16, 20, 31, 40, 49, 69, 124, 167.
2. புறநூனூறு – 03 பாடல்கள்
   பா.எண்ஹ 18, 266, 279.
3. சிலப்பதிகாரம் – வழக்குரை காதை
   80 அடிகளும், 3 வெண்பாக்களும்.
4. பெரிய புராணம் – அப்பூதியடிகள் நாயனார் புராணம்
   45 பாடல்கள்.

அலகு – 2 இலக்கணம் (12 Hrs)

தமிழ் மொழியின் அமைப்பு
சொல்லியல் – பெயர்ச்சொல், வினைச்சொல்

அலகு – 3 இலக்கிய வரலாறு (12 Hrs)

2. நாயக்கர் காலம் – சிற்றிலக்கியங்கள், உரையாசிரியர்கள்

பார்வை நூல்கள் :

1. குறுந்தொகை – உ.வே.சா., அண்ணாமலை பல்கலைப் பதிப்பகம், சிதம்பரம்.
2. புறநூனூறு – புலியூர் கேசிகன், அருணா பதிப்பகம், சென்னை.
3. சிலப்பதிகாரம் – புலியூர் கேசிகன், அருணா பதிப்பகம், சென்னை.
4. பெரியபுராணம் – தருமையாதீனம், மயிலாடுதுறை.

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
IV	I	BCHF184TS0	Sanskrit -IV	3	-	1	3

Aim:

- *To understand the value of Sanskrit.*

Objective:

- *The course concentrates to understand the story of Ramayana through Ramondantam in a good manner and also get the pleasure by reading the story of lord Krishna in a prose form through the text of vyasavacanabhag*

Outcome

- *To realize the unit features of the Sanskrit language*
- *To throw a light to understand the cultural heritage of India through the language of Sanskrit.*

Unit - I भागः – क (12 Hrs)

Ramadantam- Balakanda 1-20 Verses

Unit - II भागः – ख (12 Hrs)

Ramadantam- Balakanda 21-30 Verses

Unit - III भागः – ग (12 Hrs)

Vyasavacanabhagavatam (From Kathamukham to Putanavadha)

Unit - IV भागः – घ (12 Hrs)

Vyasavacanabhagavatam – (From Sakatabhanga to Devendragarva Bhanga)

Unit - V भागः – ङ (12 Hrs)

Poets of Sanskrit – Kalidasa, Bharavi, Magha, Sriharsa.

Text Books:

1. Ramodantam – R.S. Vadhyar and son. Palaghat.
2. Vyasavacanabhagavatam – K.Srinivasacari, The little flower & Co, Madras.
3. History of Sanskrit literature.

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
IV	I	BCHF184TH0	Hindi -IV	3	-	1	3

Aim:

- *To introduce the students to Hindi language and its correct form and to attract them towards. The beauty of Hindi.*

Objective:

- *To develop communication skills and writing skills in Hindi for the students belong to Non- Hindi speaking areas.*
- *To create opportunities to the students to enter into job filed of Central Govt. Offices through Hindi.*

Outcome:

- *Have good communication skills*
- *Have writing and reading skills*
- *Deal with the situations where they need in switch on to different languages.*
- *To avail opportunities in job field.*

Unit –I (12 hrs)

Introduction To Functional Hindi:

a) Raj Bhasha Rashtra Bhasha and Sampark Bhasha
b) Functional Hindi- Introduction

Unit – II (12 hrs)

Introduction To Official Language Terminology :

a) Technical usage of Official Terminology
b) Introduction to Official Language – Glossary

Unit – III (12 hrs)

History Of Hindi Literature:

a) Introduction to History of Hindi Literature
b) The different periods of Hindi Literature – an Outlook

Unit – IV (12 hrs)

History Of Hindi Literature- Famous Personalities

a) Famous Hindi Poets
b) Famous Hindi Prose Writers

Unit – V (12 hrs)

Letter Writing

a) Different models of Letters – Practice
b) Personal Letters- Practice
c) Official Letters - Practice

Text Book:

1. 'Saral Hindi Siksha' -2(Prepared by Department of Hindi, SCSVMV)
2. 'Hindi Sahitya Sudha' (Edited by Department of Hindi, SCSVMV)

Reference Books:

1. Saral Hindi Vyakaran – Shyam Chandra Kapoor (2009)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
IV	II	BCHF184T20	English-IV	3	-	1	3

Aim:

- *To develop professionalism in writing*

Objective:

- *Students get introduced to real life situations and language to be adopted in communication.*
- *To write clearly and effectively*
- *Ability to communicate ideas logically*
- *To offer a platform to express creativity*

Outcome:

The students are expected to be able to

- *Developed LSRW skills*
- *Write effectively*
- *Attain excellence in expressing ideas*
- *Communicate clearly and coherently.*

Unit-1: (12 Hrs)
Letter Writing
Unit II: (12 Hrs)
Comprehension
Unit III: (12 Hrs)
Report Writing
Unit IV: (12 Hrs)
Dialogue Writing
Unit V: (12 Hrs)
Group Discussion

Text Book:

Bikaram K. Das: *Functional Grammar and Spoken and Written communication in English*. Chennai: Orient Blackswan. 2006.

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
IV	III	BCHF184T30	Spectroscopic methods of analysis	4	0	1	5

Aim: *Familiarizing the concepts and simple applications of spectroscopic methods*

Objective:

- *To understand the Basic concepts of spectroscopic methods*

Outcome:

- *Understanding the principles of spectroscopy and its applications*

Unit I: Introduction to spectroscopy (15 hrs)

EM radiation, quantization of energy, regions of spectrum, interaction of radiation with matter. Origin of spectrum - representation of spectra, spectrometers, signal to noise ratio, resolving power, parameters for a spectral line- factors affecting position, intensity, width. Spectroscopy and spectrometry - differences.

Unit II: Microwave spectroscopy (15 hrs)

Rotational spectra of diatomic molecules treated as rigid rotator - condition for a molecule to be active in microwave region- rotational constants (B), and selection rule - Frequency of spectral lines, calculation of inter – nuclear distance in diatomic molecules. Isotopic substitution and its effects. Instrumentation of a MW spectrometer.

Unit III: IR and Raman spectroscopy (15 hrs)

IR: Vibrations of diatomic molecules – bond as harmonic and anharmonic 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, Determination of force constant.

Raman: 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. Mutual exclusion principle.

Unit IV: UV – Visible spectroscopy and colorimetry (15 hrs)

UV visible spectroscopy*:* Theory of electronic spectroscopy - chromophore and auxochromes - Franck - Condon principle – pre-dissociation - Description of UV-Vis spectrophotometer - Applications of UV- Visible spectroscopy

Colorimetry: - Principle of colorimetric analysis - visual colorimetry –Nessler's methods- Dubosque method -estimation of Ni^{+2} and Fe^{+3} calorimetrically - photoelectric photometer method.

Unit V: NMR and ESR spectroscopy (15 hrs)

NMR spectroscopy: nuclear spin – NMR active nuclei -theory of NMR spectra- number of signals - equivalent and non - equivalent protons - position of signals - chemical shift, δ and τ scales - Peak area and number of protons - spin – spin coupling – NMR of simple molecules.

ESR Spectroscopy: Principle of ESR - Position of ESR absorption- presentation of ESR spectrum – g factor – DPPH Radical.

Text Books:

1. Gopalan. R., Subramaniam P.S., Rengarajan K., *Elements of Analytical Chemistry*, Sultan Chand & Sons., (2004)
2. Drubha Charan Dash, *Analytical Chemistry*, PHI Learning Pvt. Ltd., 1st edition (2011)
   Donald.L.Pavia.,Gary.M.Lampman.,& George.S.Kriz.,Introduction to Spectroscopy,Cengage Learning India Pvt.Ltd.,3rd edition (2008)

Reference Books:

1. Douglas A. Skoog, F. James Holler, Stanley R. Crouch, Principles of Instrumental Analysis, Cengage; 6 edition (2014)
2. Yadhav.B. Spectroscopy, S.chand Company, 2nd edition (2007)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
IV	III	BCHF184T40	Allied Mathematics-II	3	-	1	4

Aim:

- *Introduce the students to the foundational aspects of series, ordinary differential equation, Multiple integrals, Beta & Gamma function, Numerical methods.*

Objective:

- *Solve the partial fraction and various types of series, Identify and solve the 1st order, higher order ordinary differential equation, compute the double and triple integrals, Beta and gamma functions.*
- *Solving ordinary differential equation, integration, finite differences by numerical methods.*

Outcome:

After completion of the course the students are expected to be able to

1) *Identification of different type of series and to solve the series.*
2) *To solve the Ordinary differential equation.*
3) *Have the basic knowledge in multiple integrals.*
4) *To solve problems using Beta & Gamma functions.*
5) *To solve ODE using Numerical Methods.*

Unit-I (12 hrs)

Partial Fractions - Binomial, Exponential and logarithmic Series (without Proof) - Summation -Simple problems

Unit- II (12 hrs)

Ordinary differential equations- Equations of first order and first degree - Variable separable method- Homogeneous differential equations- Linear differential equations - Higher order linear differential equations with constant coefficients- Finding particular integral of e^{ax} , sinax, cosax, x^k and $e^{ax}.f(x)$

Unit-III (12 hrs)

Evaluation of Double integral- Triple integral integrals in simple form (Cartesian only) - Beta and Gamma functions

Unit-IV (12 hrs)

Numerical solution of ordinary differential equations- Euler's Method-Modified Euler's method-Runge method- Runge- Kutta method

Unit-V (12 hrs)

Finite differences- Newton's forward difference formula- Newton's backward difference formula- Lagrange's formula- Numerical integration- trapezoidal rule- Simpson's $1/3^{rd}$ rule- Simpson's $3/8^{th}$ rule

Reference books:

1. M.D. Raisinghania, Ordinary and Partial Differential Equations, S.Chand and Co., (2001)
2. Numerical Methods, Problems and Solutions: M.K.Jain, S.r.K Iyengar, R.K.Jain (2007).
3. S.Narayanan and T.K.Manicavachagom Pillay,Calculus. S.Viswanathan Printers & Publishers Pvt. Ltd. Chennai (2004).
4. Singaravelu. A, Algebra and Trigonometry, Vol.-I & II Meenakshi Agency, Chennai. (2003)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
IV	III	BCHF184T50	Allied Computer Science-II	3	-	1	3

Aim:

- *To understand the concepts of object-oriented programming and Master oops using C++*

Objective:

- *Develop application using object-oriented programming*
- *Solving problems using object-oriented approach*

Outcome:

- *Knowledge enrichment*
- *Critical analysis where programming gaps are identified*
- *Problem solving*
- *Design and implement using C++*

UNIT - I

Definition of a Data structure - primitive and composite Data Types, Asymptotic notations, Arrays, Operations on Arrays.

UNIT - II

Stacks - Applications of Stack - Infix to Postfix Conversion, Recursion, - Queues - Operations on Queues, Circular Queue.

UNIT - III

Sorting - Bubble sort - Insertion sort - Selection sort - Quick sort - Merge sort - Heap sort - Searching - Linear search - Binary search.

UNIT - IV

Linked lists - Representation - operations - Linked stacks and queues - Doubly linked lists - Header linked lists - Polynomial addition.

UNIT - V

Trees - Binary Trees - Memory representation - Traversal algorithms - Threaded Binary trees - Binary search trees - Graph - Definition, Types of Graphs, Graph Traversal

TEXT BOOKS:

1. E.Horowitz and S. Shani Fundamentals of Data Structures in C++, Galgotia Pub. 1999

REFERENCE BOOKS:

1. Horowitz, S. Sahni, and S. Rajasekaran, Computer Algorithms, Galgotia Pub. Pvt. Ltd., 1998.
2. R. Kruse C.L. Tondo and B. Leung, Data Structures and Program design in C, PHI, 1997.

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
IV	III	BCHF184P60	Major Practical- II- Qualitative Inorganic Analysis	-	5	-	5

Semi micro inorganic analysis

Analysis of a mixture containing two cations and two anions of which one will be an interfering ion. Combination of salts forming insoluble precipitates should be avoided. Semi micro methods using the conventional scheme with hydrogen sulphide may be adopted.

Cations to be studied: lead, copper, bismuth, cadmium, iron, aluminum, zinc, manganese, cobalt, nickel, barium, calcium, strontium, magnesium and ammonium.

Anions to be studied: Carbonate, Sulphate, nitrate, chloride, fluoride, borate, oxalate, and phosphate.

Reference Books:

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons (1997)
2. R.Mukhopadhyay,P.Chatterjee.,Advanced Practical Chemistry,3rd edition,Arunabha Sen Books & Allied Pvt,Ltd. (2007)
3. V.V. Ramanujam, Inorganic semi micro qualitative analysis, 3rd edition, The National publishing company, (1974)
4. Gurdeep Raj, Advanced Practical Inorganic Chemistry,15th edition, (2001)

Scheme of Valuation	
Record	10 marks
Procedure & Analysis	70 marks
a) Acid radicals (2 x 15=30 marks)	
b) Group separation (10 marks)	
c) Basic radicals (2 x 15=30 marks)	
Result	10 marks
Viva	10 marks
Total	**100 marks**

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
IV	III	BCHF184P70	Allied Computer Science laboratory	-	3	-	2

Any 12

1. Write a C++ Program to illustrate Scope resolution operator.

2. Write a C++ Program to illustrate Class implementation

3. Implementation of Array of objects

4. Write a C++ Program to illustrate Friend function, Inline function, and Friend class
5. Write a C++ Program to illustrate the use of Constructors and Destructors and Constructor
6. Write a C++ Program to illustrate the use of Function overloading and Operator overloading
7. Write C++ Programs and incorporating various forms of Inheritance
8. Write a C++ Program to illustrate Virtual functions
9. File Handling – Read, Write, Update
10. Implementation of stack using array
11. Implementation of queue using array
12. Implementation of Insertion sort
13. Implementation of Quick sort
14. Implementation of Array insertion and deletion
15. Implementation of binary searching

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
IV	IV	BCHF184E80	Water analysis and treatment	1	-	1	1

Aim: *To study the characteristics of potable water.*

Objective:

- *To learn about various methods of treatment and analysis of water*

Outcome:

- *Students gain knowledge about various softening methods of hard water.*

Unit I: Physicochemical properties of water (5 hrs)

Introduction - characteristics of water - colour, turbidity, odour, taste, temperature, pH and electrical conductivity - Total solids -alkalinity - hardness - unit of hardness - Purification of water for drinking purpose - clarification - coagulation - contact & electro chemical coagulation - sterilization & disinfection of water - precipitation - aeration - ozonisation - Chlorination.

Unit II : Water Treatment (5 hrs)

Hard water and industries - industrial water treatment - boiler feed water - methods of softening - prevention of plumbo solvency - scales in boilers - consequences - internal conditioning methods. Desalination of brackish water - electro dialysis - Reverse osmosis. Water softening methods - Clark's process - lime soda process - modified lime soda process - permutit or zeolite process - Ion exchange process - demineralization of water.

Unit III: Water analysis (5 hrs)

Water analysis - sampling of water for analysis - chemical substances affecting potability - - Analysis of chemical substances affecting health - NH_3, Nitrate, Nitrite, cyanide, fluoride, phenolics - Dissolved oxygen - Bio Chemical Oxygen Demand (BOD) - Chemical Oxygen Demand (COD).

Text Book

1. Industrial Chemistry - B.K. Sharma - Goel publishing house, Meerut. (2003)
2. Engineering Chemistry, Jain and Jain – Himalya Publishers, New Delhi (2004)

Reference Books:

1. Pollution control in process industries - S.P. Mahajan - Tata McGraw - Hill Publishing Company Ltd., New Delhi. (1985)
2. Water pollution and management - C.K. Varashney - Wiley Eastern Ltd., Chennai - 20. (1993)

Semester-V

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
V	III	BCHF185T10	Inorganic Chemistry -I	4	0	1	5

Aim: *To study about coordination compounds*

Objective:

- *To understand the concepts of coordination and aspects of inorganic solid state chemistry*
- *To familiarize with some applications of coordination compounds*

Outcome:

- *Students get knowledge about the various theories of coordination chemistry*
- *Gets an idea about solid-state chemistry and organo metallic compounds.*

Unit I: Coordination Chemistry - I (15 hrs)

Definition of coordination compounds. Sedgwick's effective atomic number (EAN) concept-Illustrations and problems. Types of Isomerisms in coordination compounds with illustrations. Werner's coordination theory. Electrical conductivity and precipitation studies. Classification of ligands. Stability constant of coordination compounds – Stepwise and Cumulative (determination not required). Chelates –IUPAC system of nomenclature of coordination compounds.

Unit II: Coordination Chemistry - II (15 hrs)

The Valence Bond theory (VBT) of coordination compounds. Its successes and limitations. Classification as inner orbital and outer orbital complexes. Stabilization of unusual oxidation states. The crystal field theory (CFT). d-orbital splitting pattern in octahedral, tetrahedral and square planar fields. Crystal field stabilization energy (CFSE), it's calculation and importance. Evidences for covalent interaction between metal and ligands in complexes (d-d transitions, nephelauxetic effect). Racah parameter - Basic principles of Molecular Orbital Theory (MOT). The MOT of coordination compounds as applied to octahedral complexes without pi-bonding and its MO correlation diagram of $[Co(NH_3)_6]^{3+}$.

Unit III: Application of Coordination Compounds (15 hrs)

Biologically important coordination compounds - metallo phorphyrin-Chlorophyll, Haemoglobin, Vitamin B_{12} (Structure only). Synthesis and structure of metal carbonyls – carbonyls of Ni, Co, Fe and Mn - nitrosyl compounds - classification, preparation and properties - sodium nitroprusside.

Unit IV: Inorganic Solid-State Chemistry (15 hrs)

Metallic state - packing of atoms in metal (BCC, FCC, HCP and Simple cube) – theories of metallic bonding - electron gas, Pauling and band theories - structure of alloys - substitution and interstitial solid solutions - Hume Rothery ratio. Radius ratio rule & its application in determination of structure of solids like ZnS, Wurzite, fluorite, anti-fluorite - crystal defects - Schottky and Frenkel defects.

Unit V: Organometallic Compounds (15 hrs)

Definition & types –metal alkyls-Et_3Al metal pi ligand complexes- hapticity-metal alkene complexes-Zeisel salt –m-cp complexes- types-η^1 and η^5 complexes-ferrocene –preparation-structure-properties. Industrial uses of organometallic compounds-Zeigler-Natta catalysis-Fischer- Tropsch synthesis.

Text Book:

1. Madan, R.D. Modem Inorganic chemistry (1987)
2. Puri, B.R., Sharma, L.R. and Kalia, Principles of Inorganic Chemistry, New Delhi (2002)
3. Gopalan, R., Ramalingam, V. Concise Coordination Chemistry, Vikas Publishing House Pvt. Ltd. (2007)

Reference Books:

1. Soni, P.L., Text Book of Inorganic Chemistry, S, Chand & Co, New Delhi (2006)
2. Lee, J.D., Concise Inorganic Chemistry, ELBS Edition (2009)
3. Cotton.F.A., Wilkinson.G., Munillo.C.A.,Bochmann.M,Advanced Inorganic Chemistry,John Wiley Sons,(2007) .

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
V	III	BCHF185T20	Organic Chemistry -I	4	0	1	5

Aim: *To develop the knowledge about carbonyl compounds, carboxylic acids, nitrogen compounds and heterocyclic compounds.*

Objective

- *To understand the systematic chemistry of carbonyl compounds, carboxylic acids, nitrogen compounds and heterocyclic compounds.*

Outcome:

- *Students are expected to get knowledge about carbonyl groups, acid groups and nitrogen groups.*
- *Understanding on industrial process and preparation of chemicals.*

Unit I: Chemistry of carbonyl compounds (15 hrs)

Introduction - nomenclature – structure of carbonyl compounds - acidity of alpha - hydrogen nucleophilic addition (HCN, ammonia derivatives, $NaHSO_3$) – aldol – Claisen-Schmidt-Cannizaro - Benzoin – Perkin - Haloform reactions, FC acylation, Characteristic Reactions: Grignard, Metallic hydrides- Reduction reactions -Clemmenson, MPV, Wolff-Kishner reduction. Concept of enolization-Tautomerism.

Unit II: Chemistry of carboxylic acid (15 hrs)

Nomenclature - general methods of preparation of mono and dicarboxylic acids - Introduction to derivatives of carboxylic acids - physical and chemical properties - uses - nucleophilic substitution mechanism at acyl carbon - acyl chlorides, anhydrides, esters, amides – preparation and synthetic applications of diethyl malonate and ethyl aceto acetate.

Unit III: Chemistry of nitrogen compounds (15 hrs)

Nitrogen compounds - nomenclature - nitro alkanes - aromatic nitro compounds - preparation and reduction of nitro benzene under different conditions. Amino compounds - effect of substitutents on basicity, reaction of amino compounds primary, secondary, tertiary and quaternary amine compounds). carbylamine reaction, diazotization and comparison of aliphatic and aromatic amines - diazonium compounds - preparation and synthetic importance of diazomethane and benzene diazonium chloride.

Unit IV: Chemistry of heterocyclic compounds (15 hrs)

Heterocyclic compounds - nomenclature - preparation and properties of furan, pyrrole, thiophene -comparison of the basicities of pyrrole, pyridine and piperidine with amines - synthesis and reactions of quinoline, isoquinoline and indole with special reference to Skraup, Bischer Napieralski and Fischer - indole synthesis .

Unit V: Industrial organic chemistry (15 hrs)

Production of industrial chemicals by fermentation - ethanol, acetic acid and acetone- Dyes – theory of colour and constitution - chromophore, auxochrome- classification of dyes – natural dyes (Indigo) – azo dyes (Methyl Orange, Bismark brown) – triphenyl methane dyes (Malachite Green, Crystal violet)and its applications.

Text Books

1. Bahl B.S, Arun Bahl, Advanced Organic Chemistry, (12th edition) New Delhi, Sultan Chand and Co., (1997)
2. Morrison R.T., Boyd R.N., Organic Chemistry, (6th edition) New York, Allyn & Bacon Ltd., (2006)
3. K.S Tewari.,N.K Vishnoi.,A Text book of Organic Chemistry,(3rd edition)Vikas Publishing House PVT Ltd.,(2006)

Reference Books :

1. Finar I.L,Organic Chemistry, Vol 1&2, (6th edition) England, Addison Wesley Longman Ltd. (1996)
2. Pines S.H., Organic Chemistry, (4th edition) New Delhi, Mc Graw - Hill International Book company .(1986)
3. Seyhan N. Ege., Organic Chemistry, New York, Houthton Mifflin Co., (2004)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
V	III	BCHF185T30	Physical Chemistry -I	4	0	1	5

Aim:

- *To study the laws of thermodynamics and applications.*
- *To study about the colligative properties of solutions.*

Objective

- *To understand the basics of Thermodynamics.*
- *To understand the importance of Thermodynamics & their applications in day to day life.*

Outcome:

Students get knowledge about various laws of thermodynamic and the laws governing the behavior of solutions

Unit I: Thermodynamics I (15 hrs)

Definition of thermodynamic terms: system and surroundings - types of systems, Intensive and extensive properties, Thermodynamic process, Concept of heat and work. First Law of thermodynamics: statement - internal energy - its evaluation in terms of rotational, translational and vibrational degrees of freedom for gaseous molecules, Enthalpy, Heat capacities of gases at constant volume and pressure and their relationship. Joule Thomson Effect, Joule-Thomson coefficient and inversion temp. Calculation of w, q, dE and dH for the reversible expansion of ideal gases under isothermal and adiabatic conditions.

Unit II: Thermodynamics II (15 hrs)

Second Law of Thermodynamics - need for the law, Different statements of the law, Carnot cycle and its efficiency - Carnot's Theorem. Concept of entropy - entropy as a function of volume and temperature, Entropy as a function of P & T, Entropy change in physical changes - entropy as a criteria of spontaneity and equilibrium - entropy change in ideal gases and mixing of gases.

Standard states, Hess's Law of heat summation and its applications, Heat of reaction at constant pressure and at constant volume, Bond dissociation energy and its calculation, Temperature dependence of enthalpy, Kirchhoff's Equation.

Unit III: Thermodynamics III (15 hrs)

Equilibrium constant and free energy change - thermodynamic derivation of law of mass action - equilibrium constants in terms of pressure and concentration - NH_3, PCl_5, $CaCO_3$. Thermodynamic interpretation of Le chatelier's principle (concentration, temperature, pressure and addition of inert gases.) systems with variable composition. Partial molar quantities - chemical potential - variation of chemical potential with T, P and X (mole fraction), Gibb's Duhem equation. van't Hoff's reaction isotherm, van't Hoff's isochore, Clapeyron equation and Clausius – Clapeyron equation-applications-third law of thermodynamics –Nernst heat theorem,

Statement of III law and concept of residual entropy, Evaluation of absolute entropy from heat capacity data. Exception to III law (ortho and para hydrogen, CO, N_2O and ice).

Unit IV: Solutions (15 hrs)

Concept of activity and activity coefficient, completely miscible liquid systems - benzene and toluene. Raoult's law and Henry's law, deviations. Duhem - Margules equation, theory of fractional distillation. azeotropes - HCl – water and ethanol - water systems - partially miscible liquid systems - phenol - water, tri ethanol amine - water and nicotine - water systems. Lower and upper CSTs - effect of impunities on CST, completely immiscible liquids - principle and applications of steam distillation. Nernst distribution law – derivation – applications, Solvent extraction principle and derivation of a general formula of the amount unextracted. Dilute solutions: colligative properties, Relative lowering of vapour pressure, Osmosis, Law of osmotic pressure,Thermodynamic derivation of elevation of boiling point and depression in freezing point. Determination of molecular masses using the above properties. abnormal colligative properties.

Unit V: Thermodynamics of phase changes (15 hrs)

Definition of terms in the phase rule - derivation and application to one component systems - water and sulphur - super cooling, sublimation. two component systems – solid liquid equilibria, simple eutectic (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 crystallization. Freezing mixtures - $FeCl_3$ - H_2O systems, $CuSO_4$-H_2O system.

Text Books:

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. Rajaram and Kuriacose,, Thermodynamics for students of chemistry, Macmillan Publishers (1998)

Reference Books:

1. Atkins P.W., Physical Chemistry, (5th edition) Oxford Uiversity Press. (1994)
2. Castellan G.V. Physical Chemistry, New Delhi, Orient Longman. (2002)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
V	III	BCHF185SE1	Chemical Industries- Principles and Practices	1	0	1	1

Aim: *Familiarizing the concepts industrial environment and industrial processes.*

Objective:

- *To introduce the concepts of functioning of an industry, various branches of it and safety management.*

Outcome:

- *Knowledge about the industrial principles and functioning of industries.*

Unit I: Introduction to industrial organization (5 hrs)

Types of industries – chemical industries – types industrial – fine chemicals and pharmaceutical industries – importance – economic and ecological impacts. – general organizational structure – different departments – procurement – process – QC-QA – R&D - Marketing and HR departments and their roles. Working mode - hierarchy.

Unit II: Safety and waste management in industries (5 hrs)

Risk and hazard management - safety Vs production, risk assessment and analysis - analysis of hazard - Tackling disaster - plan of emergency - risk management routines- emergency shutdown systems -Role of computer in safety - prevention of hazard - human element, technology and process selection, design of safety audit system and disaster management. Importance of waste minimization –classification – housekeeping - process change-recycling - product modification - waste minimization methodology steps - benefits of waste minimization.

Unit III: Chemical industries (5 hrs)

Sugar industries: Major unit operation of sugar industry - Pollution problems - Paper & Pulp industry: Raw materials for pulp making, Kraft and Sulphite pulping methods, Pollution aspects - Textile Industry: Natural and synthetic fibers, Fiber properties important in textile production- Petro chemical Industries -Composition and characteristics - Petroleum exploration - enhanced oil recovery by water and steam injection -offfshore drilling, Petroleum refining- reforming - desulphurization polymerization etc. Important refinery products or fractions.

Report about industrial visit. (Every student has to submit the report after visiting the industry).

Text Books:

1. G.T. Austin, Shreve's Chemical Process Industries, Mc Graw Hill
2. Lees, F.P., Loss Prevention in Process Industries, Butterworths, NewDelhi, (1986)
3. Krishnan N.V. Safety Management in Industry, Jaico Publishing House, Bombay, (1997)
4. B.K.Sharma, Industrial chemistry, Goel publications

Reference Books:

1. Dryden's Outlines of Chemical Technology, Edited by M. Gopala Rao, M. Sittig, Affiliated East-West Press Ltd.
2. Accident Prevention Manual for Industrial Operations, NSC, Chicago, (1982)
3. Blake R.B., Industrial Safety, Prentice Hall, Inc., New Jersey, (1973)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
V	III	BCHF185P40	Major Practical - III	-	5	-	5

Major Practical III - (Gravimetric Analysis)

GRAVIMETRIC ANALYSIS

1. Estimation of Lead as lead chromate.
2. Estimation of Barium as barium chromate.
3. Estimation of Barium as barium sulphate.
4. Estimation of sulphate as barium sulphate.
5. Estimation of Barium as barium chromate.
6. Estimation of Calcium as Calcium carbonate.
7. Estimation of Calcium as Calcium oxalate.
8. Estimation of Nickel as Nickel-DMG.

Reference Books:

1. Venkateswaran V., Veerasamy R., Kulandaivelu A.R., Basic principles of practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons (1997)
2. R. Mukhopadhyay, P. Chatterjee., Advanced Practical Chemistry, 3rd edition, Arunabha Sen Books & Allied Pvt. Ltd. (2007)
3. Gurdeep Raj, Advanced Practical Inorganic Chemistry,15th edition, (2001)

Scheme of Valuation	
Record	10 marks
Procedure Writing	20 marks
Experiment	30 marks
Calculation	20 marks
Results < 4 % - 10 marks 6 % - 8 marks 8 % - 6 marks 10% - 4 marks > 10% - 2 marks	10 marks
Viva	10 marks
Total	**100 marks**

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
V	III	BCHF185P50	Major Practical - IV	0	5	0	5

Organic Qualitative Analysis and Organic Preparation

ORGANIC ANALYSIS

Analysis of Simple Organic compounds (a) characterization of functional groups (b) Confirmation by preparation of solid derivatives / characteristic colour reactions. Note : Mono – functional compounds are given for analysis. In case of bi-functional compounds, students are required to report any one of the functional groups.

ORGANIC PREPARATION:

Preparation of Organic Compounds (Any four)

1. Benzoic acid from benzaldehyde, 2. para-bromoacetanilide from acetanilide, 3. para-nitroacetanilide from acetanilide, 4. Phenylazo-2-naphthol from aniline, 5. Salicylic acid from methyl salicylate, 6. Osazone from glucose.

Reference Books:

1. N.S. Gnapragasam, G. Ramamurthy, Organic chemistry lab manual, 1st edition, S. Viswanathan printers and publishers Pvt. Ltd. (2006)
2. Jagmohan, Organic, Analytical chemistry, theory and practice. Narose publishing House.(2006)
3. Gnanaprakasam, Ramamurthy, Organic chemistry lab manual.
4. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons (1997)
5. R. Mukhopadhyay, P. Chatterjee., Advanced Practical Chemistry, 3rd edition, Arunabha Sen Books & Allied Pvt. Ltd. (2007)

Scheme of Valuation	
Record	10 marks
Org. preparation Crude sample (20 marks) Recrystallization (10 marks)	30 marks
Org. analysis	50 marks
Aromatic/ Alphatic (05 marks)	
Sat/Unsat (05 marks)	
Elements (10 marks)	
Functional group (10 marks)	
Derivatives (10 marks)	
Procedure (20 marks)	
Viva	10 marks
Total	**100 marks**

Semester-VI

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
VI	III	BCHF186T10	Inorganic Chemistry -II	4	0	1	5

Aim: *To study about nuclear and magneto chemistry of inorganic compounds.*

Objective:

- *To understand basic concepts of Nuclear and magnetic properties*
- *To familiarize some special types of inorganic compounds and their uses.*

Outcome:

- *Students get knowledge about the nuclear reactions, nature of radioactive elements and magnetic properties.*
- *To gain the knowledge about properties and applications of inorganic polymers.*

Unit I: Nuclear Chemistry – I (15 hrs)

Introduction - composition of nucleus and nuclear forces (meson field theory)- nuclear stability - mass defect - binding energy - packing fraction - N/P ratio, magic numbers - nuclear models - liquid drop - shell and collective model - Isotopes - detection and separation - deviation of atomic weights from whole numbers - isobars isotones and isomers.

Unit II: Nuclear Chemistry - II (15 hrs)

Radioactivity – discovery, detection and measurements, laws of radioactivity - rate of disintegration - half life and average life, group displacement law - radioactive series - nuclear transformation - use of projectiles - nuclear reactions - fission and fusion - nuclear reactors, applications of nuclear science in agriculture and medicine- carbon dating - rock dating - radioactive waste disposal.

Unit III: Some Special Type of Inorganic Compounds (15 hrs)

Binary compounds - hydrides, borides, carbides and nitrides - classification, preparation, properties and uses. some special classes of compounds - clathrates - examples and structures - Interstitial compounds. Composition, manufacture, structure properties and uses– silicates and their polymers - classification into discrete anions - one, two and three dimensional structures with examples - composition, properties and uses of beryl, asbestos, talc, mica, zeolites and ultramarines.

Unit IV: Magnetic Properties of Chemical Compounds (15 hrs)

Types of magnetic behaviors of substances, magnetic susceptibility and its measurement (Gouy method), diamagnetic correction, effective magnetic moment. Curie and Curie-Weiss law. ferro, ferri and anti ferromagnetic behaviors-Neel temperature; sub-magnetic moments. Spin – orbit coupling Spin – only moment for 3d metals - Magnetic moments for rare - earth elements.

Unit V: Inorganic Polymers **(15 hrs)**

General properties – phosphorous based chain polymers – phosphate glasses – Maddrell salt – Kuroll salt – Structure, properties and uses of Ultraphosphate glasses – boro phosphate glasses – Sulphur based polymers – $(SN)_n$ – Chalcogenide glasses – silicon based polymers – silicones – co-ordination polymers – $(AuSCN)_n$ – $PdCl_2$.

Text Books:

1. Puri, Sharma and Kalia, Principles of Inorganic Chemistry, Milestone publishers and distributors, (2010)
2. Asim. K. Das, Advanced Inorganic chemistry Vol – III, CBC Publisher (2012)
3. Gurdeep Raj, Advanced Inorganic Chemistry – Vol – I, Pragathi Prakashan, (2004)

Reference Books:

1. Soni P.L., Text book of Inorganic Chemistry, S. Chand & Co, New Delhi (2006)
2. Lee J.D., Concise Inorganic Chemistry ELBS edition (1996)
3. Satyaprakash, Tuli, G.D., Basu, S.K., and Madan, R.D, Advanced Inorganic chemistry (Vol. I & II) S. Chand, New Delhi (2006)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
VI	III	BCHF186T20	Organic Chemistry –II	4	0	1	5

Aim: *To study about carbohydrates, proteins, vitamins and molecular rearrangements.*

Objective

- *To understand chemistry and importance of biomolecules, alkaloids and terpenoids.*
- *To familiarize the mechanism of molecular rearrangements.*
- *To learn the basics of stereo isomerism in organic compounds.*

Outcome:

- *Knowledge about isomerism, types of isomerism and stereochemistry.*
- *To get an idea about natural products.*

Unit I: Stereochemistry (15 hrs)

Concept of isomerism, Types of isomerism; Optical isomerism – elements of symmetry, molecular chirality, enantiomers, optical activity, properties of enantiomers, chiral and achiral molecules,disasteromers, threo and erythro diastereomers, meso compounds, resolution of enantionmer, inversion, retention and recemization. Cahn-Ingold-Prelog sequence rules: R, S system of nomenclature.Geometric isomerism: Determination of configuration of geometric isomers. Cis - trans and E-Z system of nomenclature. Geometric isomerism in oximes. Conformational isomerism – conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives, Newman projection and Sawhorse formulae, Fischer formulae, Difference between configuration and conformation. Conformational analysis of mono and disubstitued cyclohexane. Difference in reactivity of axial and equitorially substituted rings.

Unit II: Molecular rearrangements (15 hrs)

Molecular rearrangements - types of rearrangement (nucleophilic and electrophilic) – mechanism with evidence for the following re-arrangements: pinacol - pinacolone, benzil - benzilic acid, benzidine, Claisen, Fries, Hofmann, Curtius, Beckmann, Schmidt and Cope.

Unit III: Chemistry of carbohydrates (15 hrs)

Carbohydrates - classification, properties of mono saccharide (glucose and fructose), structure and configuration of mono saccharide, interconversion, ascending and descending series, muta rotation, epimerisation- cyclic structure - determination of size of sugar rings - disaccharide - sucrose, maltose - structure elucidation - polysaccharide - starch and cellulose (elementary treatment)- Amadori rearrangement.

Unit IV: Chemistry of proteins and vitamins (15 hrs)

Amino acids - classification, general methods of preparation and reactions of amino acids, zwitter ion - isoelectric points, action of heat on α, β and γ amino acids. Peptides and proteins - Peptide linkage - polypeptide - classification of proteins - synthesis of peptides - Merrifield

synthesis - primary structure - end group analysis – Sanger's method - Dansyl chloride, Edmund method - secondary structure - tertiary structure - denaturation - colour reactions of proteins.
Vitamins (structural elucidation not needed) – classification - sources and biological importance of vitamins A, B_1, B_2, B_6, B_{12} and C.

Unit V: Chemistry of alkaloids and terpenoids (15 hrs)
Chemistry of natural products - alkaloids - isolation, classification, general methods of elucidating structure - structural elucidation and synthesis of coniine, piperine, nicotine.
Terpenes - classification - isoprene, special isoprene rule, general methods of structural elucidation - structural elucidation and synthesis of citral, limonene, menthol.

Text Books:
1. Bahl B.S, Arun Bahl,Advanced Organic Chemistry, (12th edition) New Delhi, Sultam Chand and Co., (1986)
2. Morrison R.T., Boyd R.N., Organic Chemistry, (6th edition) New York, Allyn & Bacon Ltd., (2006)
3. K.S Tewari.,N.K Vishnoi.,A Text book of Organic Chemistry,(3rd edition)Vikas Publishing House PVT Ltd.,(2006)

Reference Books:
1. Finar I.L., Organic Chemistry, Vol 1&2, (6th edition) England, Addison Wesley Longman Ltd. (1996)
2. Pine S.H., Organic Chemistry, (4th edition) New Delhi, McGraw – Hill International Book Company (1986)
3. Seyhan N. Ege,Organic Chemistry, New York, Houghton Mifflin Co., (2004)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
VI	III	BCHF186T30	Physical Chemistry - II	4	0	1	5

Aim: *To study about electrochemistry, photochemistry and surface phenomena.*

Objective:

- *To learn about the principles and applications of electrochemistry*
- *To learn about the principles of photochemistry*

Outcome:

- *Students get knowledge about titrations without using indicator.*
- *Gets an idea about photochemistry, group theory and surface phenomena.*

Unit I: Electrolytic conductance (15 hrs)

Electrical transport and conductance in metal and in electrolytic solution - specific conductance and equivalent conductance. Measurement of equivalent conductance using Kohlraush's bridge. Arrhenius theory of electrolytic dissociation and its limitation. Weak and strong electrolytes according to Arrhenius theory. Ostwald's dilution law - applications and limitations. Variation of equivalent conductance with concentration - migration of ions- ionic mobility. Kohlrausch's law and its applications. The elementary treatment of the Debye – Huckel- Onsager equation for strong electrolytes (No derivation). Evidence for ionic atmosphere -Wien effect -Debye - Falkenhagen effect.Application of conductance measurements – Determination of k_a of acids ,Determination of solubility product of a sparingly soluble salt ,Conductometric titrations.

Unit II : Electrochemical Cells – I (15 hrs)

Types of reversible electrodes - gas/metal ion - metal/metal ion; metal/insoluble salt/ anion and redox electrodes. electrode reactions - Nernst equation – derivation of cell, E.M.F and single electrode potential, Standard hydrogen electrode, Reference electrodes, Standard electrode potentials - sign convention - electrochemical series and its significance. Determination of pH using hydrogen and quinhydrone electrodes.

Unit III : Electrochemical Cells-II (15 hrs)

Electrolytic & galvanic cells - reversible and irreversible cells. Conventional representation of electrochemical cells. Electromotive force of a cell and its measurement- computation of E.M.F- calculation of thermodynamic quantities of cell reactions ΔG. ΔH, ΔS and K), Application of Gibbs Helmholtz equation. Concentration cell and E.M.F- Nernst equation, Concentration cell with and without transport- liquid junction potential. Application of EMF of concentration cells. Valency of ion- solubility product and activity co-efficient. Potentiometric titrations.

Unit IV: Photo chemistry (15 hrs)

Consequences of light absorption - Jablonski diagram- radiative and non – radiative transitions. laws of photo chemistry - Grothus - Draper and Stark – Einstein laws. quantum efficiency -

comparison between thermal and photochemical reactions. Photo sensitization and quenching-Sternn-Volmer equation. Fluorescence, Phosphorescence and Chemiluminescence - definition and examples only

Unit V: Surface Phenomena (15 hrs)

Adsorption - Physisorption and chemisorptions - Freundlich adsorption isotherm - Langmuir adsorption isotherm - BET equation (no derivation) - applications of adsorption. Catalysis: - definition - homogeneous catalysis, Function of a catalyst in terms of Gibbs free energy of activation, Heterogeneous catalysis.Kinetics of unimolecular surface reactions, Theories of catalysis – Intermediate compound formation theory, Adsorption theory. Enzyme catalysis. — explanation with suitable examples, Michaelis–Menten equation.

Text Books

1. Puri B.R., Sharma L.R., and Pathania B.K., Principles of Physical Chemistry, Vishal publishing company (2008)
2. K.K.Rohtagi-Mukherjee, Fundamentals of Photochemistry, New Age International Publishers,1978,revised edition (2002)

Reference Books

1. C.N.Banwell & Elaine McCash, Tata, Fundamentals of Molecular Spectroscopy, Fourth edition, McGraw- Hill Publishing Co.Ltd., (1994)
2. An Introduction to Electrochemistry, First edition,Samuel Glasstone,Affliated East West Press Private Ltd.1942.reprint (1999)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
VI	IV	BCHF186T60	Pharmaceutical Chemistry	1	0	1	1

Aim: *To acquire the knowledge about Analgesics, Antiseptics and disinfectants*

Objective:

- *To make the student to acquire the sound knowledge and understanding of pharmaceutical chemistry.*

Outcome:

- *A sound knowledge about basics of pharmaceutics and various types of medicines*

Unit I: Introduction to Pharmaceutical chemistry (5 hrs)

Pharmacy and pharmaceutical chemistry as a career, important aspects of pharmaceutical chemistry, important terminologies used in pharmaceutical chemistry, Importance of chemistry in pharmacy, pharmacopoeia (BP, IP, USP), National formulary, pharmaeophore, vaccines, toxoids, primary immunization, additive effect, synergism, antagonism, placebo, LD_{50}, ED_{50} and therapeutic index.

Unit II: Drug assimilation and onset of action (5 hrs)

Pharmacokinetics: Introduction to drug absorption, disposition, elimination using Pharmacokinetics, important pharmacokinetic parameters in defining drug disposition and in therapeutics. Mention of uses of pharmacokinetics in drug development process.

Pharmacodynamics: Introduction, elementary treatment of enzyme stimulation, enzyme inhibition, sulphonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.

Unit III: Common types of drugs and their applications (5 hrs)

Antibiotics: definition - structure, assay and uses of chloramphenicol and pencilin-industrial prepration-structure and use of streptomycin and tetracyclines.

Antiseptics and disinfectants: Definition and distinction- phenol coefficient- examples-phenolic compounds, dyes, cationic surfactants and chlorophenols.

Anesthetics – Definition –Classification –volatile anesthetics (N_2O, chloroform, halothane)-Ferguson principle –local anesthetics preparation and uses of procaine orthocaine and benzocaine.

Analgesics-definition classification- different types of pain– morphine-pethidine and methadone-antipyretic analgesics-paracetamol, phenacetin –Ibuprofen.

Text book

1. Jayashree Ghosh. Textbook of Pharmaceutical Chemistry. S Chand & Co Ltd, (2012)
2. Laxmi. Textbook of Pharmaceutical Chemistry, S Chand & Co Ltd, (2000)

Reference books

1. Cairns Donald, Essentials of Pharmaceutical Chemistry. Pharmaceutical Press, (2012)
2. Bentley.A.O, Driver.J.E, Atherden.L.M, Bentley and Driver's textbook of pharmaceutical chemistry, Oxford University Press, (2010)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
VI	III	BCHF186P40	Major Practical –V Physical Chemistry lab	0	5	0	5

MAJOR PRACTICAL V – PHYSICAL CHEMISTRY PRACTICALS

LIST OF EXPERIMENTS:

1. Critical Solution Temperature of Phenol – water system
2. Effect of impurity on Critical solution Temperature
3. Transition Temperature of a salt hydrate.
4. Rast's Method determination of molecular weight of a non-volatile solute
5. Phase Diagram (Simple eutectic system)
6. Kinetics of Ester Hydrolysis – acid catalyzed hydrolysis of ethyl acetate
7. Kinetics of reaction between $K_2S_2O_8$ and KI – clock reaction method
8. Conductometric Acid-Base Titration
9. Potentiometic Redox Titration
10. Determination of cell constant

Reference Books:

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons (1997)
2. R.Mukhopadhyay,P.Chatterjee.,Advanced Practical Chemistry,3rd edition,Arunabha Sen Books & Allied Pvt,Ltd. (2007)
3. A Finlay and J.A.Kitchener, Practical Physical Chemistry, Longman (1973)
4. F.Daniels and J.H.Mathews, Experimental Physical Chemistry, Longman (1985)

Scheme of Valuation	
Record	10 marks
Procedure Writing	20 marks
Experiment	30 marks
Calculation and Graph	20 marks
Result	10 marks
Viva	10 marks
Total	**100 marks**

M.Sc. Chemistry

Syllabus

(With effect from the year 2018-2019)

Department of Chemistry

Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya

(University established under sec 3 of UGC Act 1956)

(Accredited with "A" by NAAC)

Enathur, Kanchipuram – 631 561.Tamilnadu,

M. Sc [Chemistry] – Curriculum & Syllabus

(With effect from 2018-2019)

SEMESTER-I							
Subject Code	Core/ Elective	Title of the Paper	Credits/ Hrs. per week	Duration of Semester Exam	Marks		Total Marks
					IA	EA	
MCHF181T10	Core	Crystalline State and Inorganic Clusters	4	3	40	60	100
MCHF181T20	Core	Principles of Organic Chemistry	4	3	40	60	100
MCHF181T30	Core	Chemical Kinetics and Group Theory	4	3	40	60	100
MCHF181T40	Core	Analytical Chemistry	4	3	40	60	100
MCHF181P50	Core lab	Inorganic Chemistry Laboratory	(6*)	To be continued in semester II			
MCHF181P60	Core lab	Organic Chemistry Laboratory	(6*)	To be continued in semester II			
MCHF181P70	Core lab	Physical Chemistry Laboratory	(6*)	To be continued in semester II			
Distribution of working hours / Week			Theory 16 Hours/credits		Seminar 2 Hours		
SEMESTER –II							
MCHF182T10	Core	Coordination Chemistry	4	3	40	60	100
MCHF182T20	Core	Organic Transformations	4	3	40	60	100
MCHF182T30	Core	Thermodynamics and Quantum Chemistry	4	3	40	60	100
MCHF182T40	Core	Advanced Analytical Methods	4	3	40	60	100
MCHF182P50	Core lab	Inorganic Chemistry Laboratory	6	6	40	60	100
MCHF182P60	Core lab	Organic Chemistry Laboratory	6	6	40	60	100
MCHF182P70	Core lab	Physical Chemistry Laboratory	6	6	40	60	100
Distribution of working hours / Week			Theory 16 Hours/credits	Practical 18 Hours/credits			
SEMESTER-III **(Any one elective paper has to be chosen)**							
MCHF183T10	Core	Physical Methods in Inorganic Chemistry	4	3	40	60	100
MCHF183T20	Core	Organic Spectroscopy	4	3	40	60	100
MCHF183T30	Core	Electrochemistry and Spectroscopy	4	3	40	60	100
MCHF183T40	Core	Organic Reagents & Reactions	4	3	40	60	100
MCHF183E50	Core Elective-1(Any 1 out of 3)	Green Chemistry	4	3	40	60	100
MCHF183E60		Polymer chemistry					
MCHF183E70		Nanomaterials					
MCHF183P80	Core lab	Analytical Chemistry Laboratory	6	6	40	60	100
			Theory 20 Hours/credits	Practical 6 Hours/credits			
SEMESTER-IV **(Any Two elective papers have to be chosen)**							
MCHF184T20	Core	Soft Skills and Scientific Writing	4	3	40	60	100
MCHF184T10	Core	Surface Chemistry and Photo Chemistry	4	3	40	60	100
MCHF184E40	Elective-2 and 3 (Any 2 out of 4)	Synthetic Organic Chemistry	4	3	40	60	100
MCHF184E30		Nuclear and Bioinorganic Chemistry					
MCHF184E50		Supramolecular Chemistry	4	3	40	60	100
MCHF184E60		Crystal Growth					
MCHF184V60	Core viva	Comprehensive Viva	2	-	-	100	100
MCHF184Z70	Core project	Project Work and Viva-Voce	8	-	-	100	100
Distribution of working hours / Week			Theory 16 Hours/credits	Viva and project & viva-voce 8 credits			
				TOTAL CREDITS		**100**	
(*) total credits for one year				**TOTAL MARKS**		**2300**	

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
I	MCHF181T10	Crystalline State and Inorganic Clusters	4	0	0	4

Aim: *To make the student to appreciate the effect of symmetry on properties of crystals, utility of XRD in structure determination.*

Objective:

- *Understanding on properties of solids on the basis of the internal structure of the crystals.*
- *Understanding on various types of inorganic clusters.*

Outcome:

- *Successful completion of the course the students should have knowledge about the X-ray crystallography.*

Unit-I Crystal structure (15 hrs)

Types of solids – crystalline state – order – unit cell- lattice – types – lattice planes- Miller indices.Crystal geometry – symmetry – symmetry elements –space groups – types of crystals-Reciprocal lattice – construction – properties – reciprocal lattices of SC,BCC and FCC lattices -Ewald's sphere -X-ray Diffraction – Bragg's law – methods of diffraction – single crystal – powder crystal and rotating crystal methods -Crystal structure determination – scattering factor – structure factor –phase problem –space group determination.

Unit-II Structure of Ionic Solids (15 hrs)

Properties of ionic solids – lattice energy – Born-Haber cycle -Packing of atoms – AB and ABC structures – radius ratio rules - Structure of simple ionic solids - AX type NaCl, CsCl, ZnS – AX_2 type CaF_2, TiO_2 – layered structures NiAs, CdI_2 and MoS_2 -Structures of spinels and Perovskite.

Unit-III Defects and electronic structure of solids (15 hrs)

Crystal defects – types - point, line and plane defects – Schottky and Frenkel defects – colour centers thermodynamics of defect formation – non stoichiometric crystals – consequences of defects.Band theory – refinement of simple band theory – k-space – conductors, insulators and semiconductors on the basis of band theory.Superconductivity – photoconductivity – dielectric properties – pyroelectricity and piezoelectricity (Basic concepts only)

Unit-IV Properties and applications of solids (15 hrs)

Magnetic materials - metals and alloys – metal oxides –garnets – ilmenites – magneto plumbites – applications – transformer cores – information storage – memory devices – permanent magnets.Solid state electrolytes – types - examples – applications – electrochemical cells – batteries- sensors and fuel cells.Crystallization – growth of single crystals – Czochralski – Bridgman and Stockbarger – zone melting - melt :flux methods

Unit-V Inorganic Rings chains and Clusters (15 hrs)

Silicates – chain silicates - 2D and 3D silicates – Beryls – Muscovite – aluminosilictaes – zeolites(structures only)-Carboranes – types- nomenclature – metalloboarnes (Structures only)-classification-Metal clusters – Re_2Cl_8 type clusters – structure – qualitative MO diagram – quadruple bond

Text Books

I. *Chaklrabarthy.D.K, Solid state chemistry, New Age India limited, 2005.*
II. *Velmurugan.D, Elementary crystallography, MJP Publishers, 2010.*
III. *West Anthony R. Solid State Chemistry and Its Applications. Wiley, 2014*
IV. *Shriver and Atkins , Inorganic Chemistry, Oxford University Press,2014*

Reference Books

1. *James Huheey, Ellen A.Keiter and Richard L.Keiter , Inorganic Chemistry Principles of Structure and Reactivity, Pearson Education Asia, 2001.*
2. *J.D. Lee, Concise Inorganic ChemistryWiley India Ltd., Sixth edition, 2008*
3. *Gurdeep Raj, Advanced Inorganic Chemistry, Eleventh edition, Vol. II, Goel Publishing House, 2008.*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
I	MCHF181T20	Principles of Organic Chemistry	4	0	0	4

Aim: *To learn about Reaction intermediates and stereochemistry of compounds.*

Objectives:

- *To learn the Nucleophilic Substitution and Electrophilic Substitution Reactions*
- *To understand the different types of organic reactions.*

Outcome:

- *Understanding on organic reaction kinetics and stereochemistry of reactions.*
- *Understanding on various types of organic reaction and reaction intermediates.*

Unit-I Reaction intermediates (15 hrs)

Nomenclarure of aromatic and heteroaromatic compounds: Hetero cyclics with not more than two heteroatoms (oxygen/sulfur/nitrogen)

Stability, generation and applications of carbocations, carbanions, free radicals, carbenes, nitrenes, benzynes.ylides, enamines.

Unit-II Reactions: mechanisms and their determinations (15 hrs)

Principle of Equilibria and free energy, free energy change in relation to bond strengths, activation energy, measurement of activation energy, reaction profile diagrams, rate determining step, thermodynamic and kinetic control, applications of kinetic principles (Hammond postulate, effect of solvent on reaction rate), Curtin-Hammett principle, Hammett equation,Swain-Scott equation, Grunwald-Winstein equation,microscopic reversibility, methods of determiningmechanisms.

Unit-III Stereochemistry I (15 hrs)

Stereoisomerism: Introduction, molecular representation, classification of isomers based on: symmetry criterion, energy criterion, stereoisomerism, conformation and chirality. Nomenclature: Fischer's D and L and R and S. E and Z nomenclature, Stereochemistry of allenes, Biphenyl derivatives and atropisomerism, Stereoselective and stereospecific reactions, Homotopic, enantiotopic and diastereotopic ligands (definitions only)

Unit-IV Stereochemistry II (15 hrs)

Stereochemistry of cyclic and acyclic systems, conformations of ethane, 1,2-disubstituted ethanes, effect of conformation on reactivity (E_2 elimination, Curtin-Hammett principle, Wagner-Meerwein rearrangement. Conformations of cyclopentane, cyclohexane, methyl cyclohexane, 1,2- 1,3- and 1,4-dimethyl cyclohexanes. Molecular dissymmetry and chirotropic properties, circular birefringence, and circular dichroism, Cotton effect, applications of ORD andCD, Axial halo ketone rule, Octant ruleconformational effects on reactivity (Ester hydrolysiswith a base, Cyclohexnol oxidation with chromium trioxide and water, Intramulecular closure of halohydrin to form epoxide), NGP, Determination of 2-amino cyclohexanol

Unit-V Nucleophilic Substitution Reactions (15 hrs)

Aliphatic nucleophilic substitution reactions- Introduction, S_N2 mechanism, S_N1 mechanism, (effects of substrate, attacking nucleophile, leaving group and solvent), S_N1 vs S_N2 reactions, neighboring group participation and non-classical carbocations. Aromatic nucleophilic substitution reactions – S_NAr general mechanism, Aryl cation mechanism, benzyne mechanism.

Text books:

I. *D. Nasipuri, Stereochemistry Organic Compounds, Principles and applications, Second edition, New Age International (P) Ltd., 1994, Reprint 2008.*
II. *P.S. Kalsi, Stereochemistry Conformation and Mechanism, Seventh edition, , New Age International Publishers, 2008.*
III. *P.S. Kalsi, Organic Reactions and their mechanisms, Third edition, New Age International Publishers, 2010.*

Reference Books:

1. *Jerry March, Advanced Organic Chemistry, Reactions, Mechanisms and structures, Wiley Students edition, 2006.*
2. *F.A. Carey and R.I. Sundberg, Advanced Organic Chemistry, Part A & B, 5th Ed., Springer, 2009.*
3. *V.K. Ahluwalia, R.K. Parashar, Organic Reaction Mechanisms, Third edition, Narosa Publishing House, 2009.*
4. *Peter Sykes, A guide book of mechanism in organic chemistry, Pearson, 6th Ed., 2006.*
5. *Ernest.L.Eliel,Samuel H.Wilen,L.N.Mander, Stereo chemistry of Organic compounds, John Wiley & Sons., New York, 2003.*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
I	MCHF181T30	Chemical Kinetics and Group Theory	4	0	0	4

Aim: *To study about Chemical Kinetics and Group Theory*

Objectives:

- *To understand the concepts and applications of reaction kinetics.*
- *To understand the symmetry of molecules and its applications.*

Outcome:

- *Students will get an idea about the applications of Group Theory to various Molecules.*

Unit-I Theories of reaction rates (15 hrs)

Effect of temperature on reaction rates, Arrhenius equation for simple reactions, Energy of activation, Potential energy surfaces, an introduction, Collision theory, factors affecting effective collision, Weakness of collision theory, reaction cross section, comparison with Arrhenius equation, Transition state theory, thermodynamic treatment, Unimolecular reactions, Lindemann's mechanism, Rice Ramsperger Kassel (RRK) model.

Unit-II Complex reactions (15 hrs)

Kinetics of reversible reactions, consecutive and parallel reactions,Kinetics of chain reactions, H_2&Br_2, H_2 & O_2, decomposition of CH_3CHO & N_2O_5, Study of fast reactions, flow technique, stopped flow techinique, temperature and pressure jump methods, shock tubes.

Unit III Reactions in solutions (15 hrs)

Solvent effects, factors affecting reactions rates, ARRT as applied to solution phase, effect of internal pressure, reactions between ions, single sphere and double sphere mechanisms, influence of ionic strength, pressure and dielectric constant, volume of activation, diffusion controlled reactions: an introduction, Linear free energy relations, Hammett equation.

Unit-IV Group theory – fundamentals (15 hrs)

Theory of groups, classes, sub groups, similarity transformations, point group classification, isomorphism, Matrix representation of symmetry operations, reducible and irreducible representations, decomposition of irreducible representation in to reducible representation, properties of irreducible representation, notations and theorems related to irreducible representations, Projection operator, theorems of representation, construction of character tables for C_2v and C_3v point groups, direct product representation.

Unit-V Group theory – applications (15 hrs)

Applications of group theory to molecular vibrations (H_2O & ethylene), group theoretical treatment of hybridization (methane & boron trifluoride), SALC procedure for butadiene. Electronic spectrum of formaldehyde,Selection rules for IR and Raman spectrum, Woodward and Hoffmann rules.

Text Books

I. *J. Rajaram, J. C. Kuriacose, Kinetics and Mechanisms of Chemical Transformations, First edition, Macmillan, 1993, reprint 2011.*
II. *Peter Atkins, Julio de Paula, Physical Chemistry, Eighth edition, Oxford press, 2006.*
III. *P.C. Jain and Monika Jain, Engineering Chemistry, 15th editionDhanpat Rai Publishing Co., 2008.*
IV. *F.A. Cotton, Chemical Applications of Group Theory, Third edition, John Wiley & Sons, 1990, reprint 2006.*
V. *M.S.Gopinathan and V. Ramakrishnan, Group theory in Chemistry, Second edition, Vishal Publications, 1991, reprint 2001.*

Reference Books

1. *Donald A. Mcquarrie, John D. Simon, Physical Chemistry, First edition, Viva Books,1998.*
2. *K. Veera Reddy, Symmetry and Spectroscopy of Molecules, Second edition, New Age International, 2009.*
3. *Keith.J. Laidler, Chemical Kinetics, Third Edition, Pearson Education, 2004.*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
I	MCHF181T40	Analytical Chemistry	4	0	0	4

Aim: *To Understand the basic concepts of analytical techniques*

Objective:

- *To impart the knowledge of various analytical chemistry methods.*

Outcome:

- *The students will acquire knowledge of,*
- *Data handling and statistical treatment of data*
- *Principles of wet analytical methods, thermal analytical methods, optical methods, chromatographic techniques and electro analytical techniques and its applications*

Unit-I Errors & Laboratory Procedures (15 hrs)

Significant figures, rules for determination, definition and classification of errors, accuracy and precision, methods of expressing accuracy (absolute error, relative error), comparison between accuracy and precision, methods of expressing precision (mean, median, range, standard deviation, variance), test of significance (F-test, chi square test, Q-test). Classification of chemicals, rules for handling reagents and solutions, measurement of mass (Electronic analytical balance only)

Unit-II Wet Analysis (15 hrs)

Volumetric analysis – acid base, redox & complexometric titrations- theory and experiment. Gravimetric analysis - precipitation methods- homogeneous precipitation-filtration, washing, drying, weighing-Colorimetric analysis – photoelectric colorimeter – single beam and double beam schematic diagrams, applications.

Unit-III Thermal and Spectral Methods (15 hrs)

Thermal Analysis: TGA, DTA, DSC - principles, instrumentation and applications. Spectral Methods**:** UV-Visible spectroscopy- Beer Lamberts Law, Description of UV-Vis spectrophotometer Applications of UV- Visible spectroscopy -Infrared spectroscopy – instrumentation, single beam and double beam spectrometers, sample handling, FTIR spectrometer

Unit-IV Chromatographic Techniques (15 hrs)

Paper Chromatography – theory, techniques and applications. Column Chromatography – principles, experimental requirements, identification of compounds and applications. Thin layer Chromatography – theory, techniques and applications. Gas Chromatography – principle, theory, instrumentation, identification of chromatogram. High Performance Liquid Chromatography – instrumentation and applications.

Unit-V Electroanalytical Methods (15 hrs)

Conductometric titrations – principle, practice and applications-Amperometric titrations – principle, instrumentation and applications-Potentiometry – instrumentation, electrodes, potentiometric titrations-pHmetry -Glass electrode and Ion selective electrodes-Electrogravimetry – theory, electrolysis at constant current and constant voltage-principle, experimental set up and applications-Coulometry – coulomb calculation, silver coulometer, constant current Coulometry.

Text Books

I. *Dhruba Charan Dash, Analytical Chemistry, PHI Learning Private Ltd., 2011.*
II. *H. Kaur, Instrumental Methods of Chemical Analysis, Sixth edition, Pragati Prakashan, 2010.*
III. *Douglas A. Skoog, Donald M. West, F. James Holler, Analytical Chemistry An Introduction, Sixth Edition, Saunders College Publishing, 1994.*

Reference Books

1. *Douglas A. Skoog, F. James Holler, Stanley R. Crouch, Instrumental Analysis, Brooks/Cole Cengage Learning (I) Pvt. Ltd.,, First Indian Reprint 2008.*
2. *Gurdeep R. Chatwal, Sham K. Anand, Instrumental Methods of Chemical Analysis, Fifth edition, Himalaya Publishing Company, 2007.*
3. *H.H. Willard, L.L. Merritt Jr., J.A. Dean, F.A. Settle, Instrumental Methods of Analysis, Seventh edition, CBS Publishers & Distributors, 1986.*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
II	MCHF182T10	Coordination Chemistry	4	0	0	4

Aim: T*o understand the basic principles of coordination chemistry*

Objectives:

- *Learning about the various theories of complex formation.*
- *Studying and interpreting the magnetic properties of complexes.*

Outcome:

- *Students will get an idea about basics of metal complex formation and explain the properties of complexes on the basis of CFT and MOT.*

Unit-I Theories of metal complexes (15 hrs)

Co-ordination compounds – detection of formation – isomerism in complexes-Historical background of theories of metal complexes – Werner's –Sidgwick and valence bond theories Crystal field theory(CFT) – assumptions – splitting of d orbitals in different fields – CFSE calculations – evidences for splitting factors affecting splitting –spectrochemical series – Jahn-teller distortion – limitations of CFT Ligand Filed Theory (LFT) – sigma and pi bonding in complexes – evidences for pi bonding – MO diagrams for Oh and Td complexes – effects of pi donors and pi acceptors on splitting – nephelauxetic effect and series.

Unit-II Stability and reactions of complexes (15 hrs)

Stability of complexes kinetic and thermodynamic stabilities- formation constants – stepwise and overall formation constants- factors affecting stability of the complexes -Kinetics and mechanisms of ligand substitution reactions in Oh complexes- acid hydrolysis – base hydrolysis
- factors affecting the rate of reactions- anation reactions Substitution in SP complexes – trans effect- theories of trans effect –applications Redox reactions of complexes – inner sphere and outer sphere mechanisms- Marcus theory.

Unit-III Magnetic properties of metal complexes (15 hrs)

Basic definitions in magneto chemistry – thermal energy and magnetic properties- magnetism on the basis of crystal field model .Zeeman effect – second order Zeeman effect on Sm(III)
Spin pairing – applications Anomalous magnetic moments – reasons -Co-operative magnetism – antiferro magnetism – direct M- M interaction – super exchange – examples – Ferro magnetism (Concept only)

Unit-IV Organometallics (15 hrs)

Types of organometallics – 18 e- rule –alkene complexes – Zeise's salt – Hapticity Metal allyl complexes – metal acetylene complexes -Metal sandwich complexes – Ferrocene – preparation structure and reactivity-Reactions of organometallics – oxidative addition reductive elimination – industrial applications of organometallics – Wilkinson's catalysts- Reppe's process- Oxo process-Wacker's process and Ziegler-Natta catalysts.

Unit-V Metal Carbonyls and Nitrosyls (15 hrs)

Metal carbonyls – classification – description of M-CO bond- terminal and bridging CO groups – carbonyls of V, Mn, Fe and Co. Metal carbonyl hydrides and metal carbonyl halides-Metal nitrosyls - liner and bent nitrosyls- preparation and properties - nitrosyls of iron.

Text Books

I. *James Huheey, Ellen A.Keiter and Richard L.Keiter, Inorganic Chemistry Principles of Structure and Reactivity, Fourth edition, Pearson Education Asia, 2001.*
II. *Shriver and Atkins, Inorganic Chemistry, Third edition, Plenum Press, .*
III. *Wahid U.Malik, G.D.Tuli and R.D.Madan, Selected Topics in Inorganic Chemistry, First Edition, S.Chand and Company Ltd., 1976 (Reprint 1998).*
IV. *R.Gopalan and V.Ramalingam,Concise Coordination Chemistry, First edition, Vikas Publishing House Private Ltd., 2001 (Third reprint 2007).*

Reference Books

1. *F.Albert cotton, Advanced Inorganic Chemistry, Sixth edition, Geoffrey Wilkinson, Carlos.A.Murilo and Manfred Bochmann, Wiley India, 2004 (Reprint 2008).*
2. *Gurdeep Raj,Advanced Inorganic Chemistry, Eleventh edition, Vol. II, Goel Publishing House, 2008,*
3. *Agarwal and Keemti Lal, Advanced Inorganic Chemistry, Eleventh edition, Pragati Prakashan, 2012.*
4. *J.D. Lee, Concise Inorganic Chemistry, Sixth edition, Wiley India Ltd., 2008.*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
II	MCHF182T20	Organic Transformations	4	0	0	4

Aim: *To understand the mechanism of organic reactions*

Objectives:

- *To understand the mechanism of molecular rearrangements*
- *To acquire knowledge in natural products*

Outcome:

- *Students will acquire knowledge in mechanism of various organic reactions*
- *Learn about the preparation and uses of natural products*

Unit-I Electrophilic Substitution Reactions (15 hrs)

Arenium ion mechanism -S_E^2 reaction (nitration, sulphonation, halogenation, Friedel-Crafts alkylation, acylation), Vilsmeier-Hack formylation, substitution on monosubstituted benzenes – orientation and reactivity – activation and deactivation (inductive effect, mesomeric effect), examples of ortho & para directing groups, meta directing groups, activating and deactivating substituent's and their synthetic applications.

Unit-II Addition and elimination reactions (15 hrs)

Addition to double bonds: Addition of Halogens & Hydrogen Halides, Electrophilic addition to alkynes, Nucleophilic addition to alkenes and alkynes, Nucleophilic addition to carbonyl compounds-Hydride reduction-hemiacetals and acetals. E_2 mechanism, direction of elimination in E_2, rate of E_2 reactions, stereochemistry of E_2 elimination, E_2 elimination from acyclic systems & cyclohexane systems, E_1 mechanism, direction of elimination, E_1 elimination from cyclic compounds, Curtin-Hammett principle.

Unit-III Molecular rearrangements (15 hrs)

Pinacol-pinacolone, Wagner-meerwein, wolff, benzyl-benzilic acid, Beckmann, Hofmann, Curtius, Lossen, Schmidt, Baeyer-Villiger, Hydroperoxide, Dakin, Favorskii, Stevens, Sommelet-Hauser, Wittig, Neber, Fries, Claisen, dienone-phenol rearrangements and their mechanisms.

Unit-IV Organometallic compounds (15 hrs)

Grignard reagents, organolithium, organocopper- Gilmans reagent, Gignard –copper- I reagent-reactions of organo cuprates, epoxide cleavage, conjugate addition, Tandem-1,4-addtion, organozinc-alkyl zinc iodides-di alkyl zinc-reformatsky reaction-cyclopropanation-Dibal-H reduction, Julia olefinations, Petersons olefination.

Unit-V Alkaloids (15 hrs)

Occurrence-functions-nomenclature-classification-isolation-general structure determination-synthesis and structural elucidation of quinine, papaverine, morphine.

Text Books

I. *P.S. Kalsi, Organic Reactions and Their Mechanisms, Third edition, New Age International Publishers, 2010.*
II. *V.K. Ahluwalia, R.K. Parashar, Organic Reaction Mechanisms, Third edition, Narosa Publishing House, 2009.*
III. *W.Caruthers, Iain Coldhan, Modern Methods of Organic Synthesis, Cambrodge university press,2015.*
IV. *I.L.Finar, Organic Chemistry Vol-II, Pearson Education, 2002.*

Reference Book

1. *Jerry March, Advanced Organic Chemistry: Reactions, Mechanisms and Structure, Wiley Student Edition, 2006.*
2. *ROC.Norman and J.M coxon, Principles of organic synthesis Modern synthesis,CRC press,1993*
3. *Francis. A Carey and Richard. J Sundberg, Advanced Organic Chemistry:Part-B:Reaction and synthesis,Springer,2008*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
II	MCHF182T30	Thermodynamics and Quantum Chemistry	4	0	0	4

Aim: *To understand the basics of Thermodynamics and quantum mechanics*

Objectives:

- *To understand the fundamentals and applications of statistical thermodynamics.*
- *To study the basics and applications of chemical thermodynamics.*
- *To study the fundamentals and applications of quantum chemistry.*

Out Come:

- *Students will get Knowledge about Various types of Quantum Statistics.*

Unit-I Thermodynamics of open systems (15 hrs)

Partial molar properties, chemical potential, partial molar volume, partial molar heat content, variation of chemical potential with temp. and pressure, fugacity, determination of fugacity, variation with temp., and pressure. Thermodynamics of ideal and non-ideal solutions. Excess functions for non-ideal solutions. Concepts of activity and activity coefficients, detn. of activity and standard free energy, choice of standard states.

Unit-II Third law of thermodynamics & classical statistics (15 hrs)

Nernst heat theorem, need for third law, third law of TD's, experimental verification of third law, entropies of real gases, entropy changes in chemical reactions, Boltzmann entropy equation, residual entropy, statistical meaning of third law. Introduction to statistical thermodynamics, terminologies, Liouville's theorem, statistical equilibrium, thermodynamic probability, Boltzmann statistics, partition function, translational, rotational, vibrational and electronic partition function, partition functions and thermodynamic functions (internal energy, heat capacity, entropy, work function), partition function for monatomic and diatomic molecules, limitations of Boltzmann's statistics.

Unit-III Quantum statistics (15 hrs)

Bose-Einstein statistics, Bose-Einstein condensation, Fermi-Dirac statistics, Fermi energy, Fermi energy of electron gas in a metal, thermionic emission, comparison between MB, FD & BE statistics.

Unit-IV Basics of quantum mechanics (15 hrs)

Inadequacy of classical mechanics, black body radiation, photoelectric effect, Bohr's quantum theory, Davisson & Germar experiment, wave particle duality, Compton effect, De-broglie's equation, Uncertainty principle, theory of wave motion, Schrodinger's equation for particle waves, wave function and its physical meaning,Postulates of quantum mechanics, operatoralgebra, Eigen values, Eigen functions, particle in a box (1-D and 3-D), quantum numbers, zero point energy. Self Study (not for exams): Harmonic oscillators and rigid rotors.

Unit-V Applications of quantum mechanics (15 hrs)

Approximation methods, perturbation and variation methods, application to hydrogen and helium atom, R-S coupling and term symbols for atoms in the ground state, HFSCF theory, Slater determinant, Born-Oppenheimer approximation, hydrogen molecule ion, hydrogen molecule, Concept of hybridization, Huckel's theory (ethylene, 1,3-butadiene and benzene).

Text Books

I. *B.R. Puri, L.R. Sharma & Madan S. Pathania, Principles of Physical Chemistry, 42nd edition, Vishal Publishing Company, 2008.*
II. *R.P. Rasthogi & R.R. Misra, An Introduction to Chemical Thermodynamics, Sixth edition, Vikas Publishing House, 2008.*
III. *S.K. Sinha, Introduction to Statistical Mechanics, First edition, Narosa Publishing House, 2005.*
IV. *R. K. Prasad, Quantum Chemistry, Third edition, , New Age International, 2007.*
V. *Gurdeep Raj, Advanced Physical Chemistry, 22nd edition, Goel Publications, 1998.*

Reference Books

1. *Donald A. Mcquarrie, John D. Simon, Physical Chemistry, First edition, Viva Books, 1998.*
2. *Peter Atkins, Julio de Paula, Physical Chemistry, Eighth edition, Oxford press, 2006.*
3. *Moudgil, The text book of Physical Chemistry, Printice hall publication, 2010.*
4. *Donaua.Mcquarrie, Qunatum Chemistry, Second Edition, University Science books Publication, 2007.*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
II	MCHF182T40	Advanced Analytical Methods	4	0	0	4

Aim: *To know about spectroscopy*

Objective:

- *To impart the knowledge of various advanced analytical techniques for chemical characterization.*

Outcome:

- *The students will acquire knowledge of principles, instrumentation and applications of separation techniques, AAS, inductively coupled plasma atomic emission spectroscopy, NMR, XRD, fluorescence spectroscopy, and mass spectrometry*.

Unit-I Separation techniques **(15 hrs)**

Capillary electrophoresis: Theory, instrumentation and applications. Ion Chromatography: Theory, instrumentation, and applications.

Unit-II AAS & ICP **(15 hrs)**

Atomic Absorption Spectrometry: Introduction, basic principles, instrumentation, quantification of elements, applications. Inductively coupled Plasma Atomic Emission Spectroscopy: Introduction, physical and chemical principles, instrumentation, applications.

Unit-III NMR & XRD **(15 hrs)**

NMR: Theory, instrumentation, and applications. X-ray diffraction: Introduction, theory, instrumentation and applications.

Unit-IV Fluorescence Spectroscopy & Microscopic Methods **(15 hrs)**

Theory, instrumentation and applications of Fluorescence spectroscopy. Principle, instrumentation and applications of SEM and TEM techniques.

Unit-V Techniques of Mass Spectrometry **(15 hrs)**

Different ionization techniques, and detectors in mass spectrometers, basic instrumentation of MS, and applications, GC-MS, LC-MS.

Text Books

I. *Skoog, Holler, and Crouch, Instrumental Analysis, Brooks/Cole, 2007.*
II. *Willard, Merrit, Dean, Settle, Instrumental Methods of Analysis, Seventh edition, CBS publishers and distributors, 1986.*
III. *Skoog, West, Holler, Analytical Chemistry: An Introduction, Sixth edition, Saunders College Publishing, 1994.*
IV. *Khopkar, S.M., Basic Concepts of Analytical Chemistry, New Age International (P) Limited, Publishers, (2008).*

Reference Book

1. *Frank Settle, Handbook of Instrumental Techniques for Analytical Chemistry, Pearson education, 1997.*
2. *Silverstein, Bassler, Morrill, Spectrometric identification of organic compounds, John Wiley & Sons, 1991.*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
II	MCHF182P50	Inorganic Chemistry Laboratory	0	6	0	6

1. **Separation and Analysis** of an "Inorganic mixture containing two common and two less common metal ions" including the following:
   Common Ions: Pb, Cu , Bi, Cd, Al, Ni, Co, Mn, Zn, Ba, Ca, Sr and Mg; **Less common Ions**: W, Se, Te, Mo, Ce, Th, Zr, Ti, V, U, and Li

2. **Estimation of metals in a mixture (Volumetry and Gravimetry)**
   - Copper (V) - Nickel (G)
   - Copper (G) – Zinc (V)
   - Iron (V) – Nickel (G)
   - Iron (V) – Magnesium (G)
3. **Colorimetric Estimation** of Cu,Cr,Fe,Ni and Mn

4. **Preparation** of *any five* of the following complexes:
   i. Tetraamminecopper(II) sulphate,
   ii. Potassium trioxalatochromate(III),
   iii. Hexaureachromium(III) chloride,
   iv. Sodium trioxalatoferrate(III),
   v. Tris(acetylacetanato)copper (II),
   vi. Tris(ethylenediamine)nickel (II) chloride

Reference Books

1. *V.V. Ramanujam, Inorganic Semi-micro-Analysis, 3rd edition, The National publishingcompanay, 1997.*
2. *Gurdeep Raj, Pragathi Prakasan, Advanced Inorganic Practical, Meerut.*
3. *Vogel's Text book of Quantitative Analysis, Longman Group publishers, 5 th edition, 1994.*
4. *G.B.Kauffmann, Inorganic Coordination Compounds, Heyden and Son Ltd.*
5. *Burger,Synthesis of Inorganic Complexes, 1973.*

Scheme of Evaluation

S.No.	Particulars	Max. marks
1	Analysis of the mixture (Group separation-10, Analysis of each cation-10)	50
2	Preparation	30
3	Viva-voce	10
4	Record	10
Total		**100**

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
II	MCHF182P50	Organic Chemistry Laboratory	0	6	0	6

1. Separation and Analysis of an organic binary mixture and derivatisation of the components.

2. Preparation of organic compounds (Any 8 from the following list): 1. Benzoic acid from benzaldehyde, 2. Salicylic acid from methyl salicylate, 3. o-chlorobenzoic acid from anthranillic acid, 4. Resacetophenone from resorcinol, 5. Para bromoacetanilide from acetanilide, 6. para-nitroacetanilide from acetanilide, 7. Dibenzalacetone from acetone, 8. Benzhydrol from benzophenone, 9. Phenylazo-2-naphthol from aniline, 10. Glucose penta acetate from glucose, 11. Piperidone from ethyl acetoacetate, 12. Naphthylmethyl ether from β-naphthol

Reference Books

1. *Jag Mohan, Organic, Analytical chemistry, theory and practice. Narose publishing House, 2006.*
2. *Gnanaprakasam, Ramamurthy. Organic chemistry lab manual.*

Scheme of Evaluation

S. No.	Particulars	Max. marks
1	Analysis of the mixture (each component -25)	50
2	Preparation	20
3	Pilot separation	10
4	Viva-voce	10
5	Record	10
Total		**100**

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
II	MCHF182P70	Physical Chemistry Laboratory	0	6	0	6

Electrochemistry Experiments

Conductometry Experiments

1. Titration of : 1. Strong acid Vs strong base, 2. Weak acid Vs Strong base, 3. Weak acid Vs weak base
2. Titration of a strong base Vs mixture of acids.
3. Precipitation titration: 1. $BaCl_2$ Vs $MgSO_4$, 2. $AgNO_3$ Vs mixture of halides
4. Verification of Debye - Huckel – Onsager relation for a strong electrolyte
5. Dissociation constant of a weak electrolyte.
6. Solubility and solubility product of a sparingly soluble salt.

Potentiometry Experiments

1. Dissociation constant of a weak acid: titration method
2. Dissociation constant of a weak acid: Henderson method
3. Redox titration: $KMnO_4$ Vs Fe^{2+} / $KMnO_4$ Vs KI
4. Precipitation titration: $AgNO_3$ Vs mixture of halides
5. Standard reduction potential of Cu / Zn / Ag electrode
6. Formal redox potential of Fe^{2+} / Fe^{3+} or Ce^{3+} / Ce^{4+} system
7. Solubility product of a sparingly soluble salt by (i) Single electrode method (ii) Concentration cell method.

Non- Electrochemistry Experiments

1. Determination of partition coefficient of I_2 between water and CCl_4. Equilibrium constant for the formation of I^{3-} ion.
2. Construction of phase diagram for a pair of partially miscible liquids and the effect of added impurity.
3. Construction of phase diagram for a three partially miscible liquids.
4. Construction of phase diagram for a simple eutectic system.
5. Construction of phase diagram for a system with compound formation
6. Determination mol.wt of a non-volatile solute by Rast's method
7. Determination mol.wt of a non-volatile solute by transition temperature method
8. Study of adsorption of oxalic acid on charcoal. (Verification of Freundlich's isotherm)
9. Determination of integral heat of solution by solubility method.
10. Determination of heat hydration of anhydrous $CuSO_4$.
11. Determination of rate, order of the reaction between $K_2S_2O_8$ and KI (clock reaction method)
12. Verification of Bronsted –Bjerrum equation with reaction between $K_2S_2O_8$ and KI.
13. Determination of order of the reaction for base hydrolysis of an ester- Condutomentric method
14. Kinetics of acid catalyzed iodination of acetone – spectrophotometeric method.
15. Determination of Arrhenius parameters for acid catalyzed hydrolysis of ester.

Reference Books

1. *A.Finlay and J.A.Kitchener, Practical Physical Chemisty, Longman, 1973.*
2. *F.Daniels and J.H.Mathews Experimental Physical Chemistry, , Longman, 1985.*
3. *A.M.James, J.A.Churchil,Practical Physical Chemistry, 1961.*
4. *H.H.Willard, L.L.Merritt and J.A.Dean,Instrumental Methods of Analysis, Affiliated East-West Press, 1965.*
5. *D.P.Shoemaker and C.W.Garland, Experimental Physical Chemistry, McGraw-Hill, 1974.*

Scheme of Evaluation

S.No.	Particulars	Max.marks
1	Aim & Principle	5
2	Procedure, Formula, Model graph & Table	25
3	Reading & Calculation	30
4	Graph	10
5	Result	10
6	Record	10
7	Viva-voce	10
Total		**100**

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
III	MCHF183T10	Physical Methods in Inorganic Chemistry	4	0	0	4

Aim: *To study about utility of spectroscopic techniques in study of inorganic compounds.*

Objectives*:*

- *To understand the role of spectroscopic methods in inorganic chemistry.*
- *To acquire basic knowledge about the application of spectral methods in structural elucidation of inorganic compounds.*

Outcome:

- *Students will Understand the importance of various spectral methods in structural elucidation of inorganic compounds*

Unit-I Infra red & Raman spectroscopy (15 hrs)

Infrared spectroscopy: Principle – molecular vibrations – types- vibrational energy of a molecule – Selection rules – dipole moments in the vibrating molecule –IR activity conditions - anharmonicity of vibrations –consequences – expressions for fundamentals –overtones and hot bands – coupling of rotations and vibrations. Normal mode analysis of C2V group (H_2O , SO_2 and ClO_2) – ZXY_2 type molecule – square planar XY_4 complexes($AuCl_4$). Raman spectroscopy: Raman effect – Raman, Rayleigh and fluorescent scatterings –polarized Raman lines- conditions for Raman activity. Structure of molecules from IR and Raman spectra – mutual exclusion principle – violation of the principles – dynamic modes of molecules – structure determination - identification of coordination – site symmetry lowering (SCN-, NO_3- SO_4^{2-} and Urea as ligands).

Unit-II Electronic spectra (15 hrs)

Free ion configurations –terms and states –spin orbit coupling –L-S coupling scheme –j-j coupling scheme – terms for p^2 and d^2 configurations – hole formalism – energy of terms – Hund's rule – inter electronic repulsion parameters – spin –orbit coupling parameters.Effect of crystal fields on terms – S, P, D and F terms – Ligand field term diagrams – Orgel diagrams – expected electronic transitions – term interactions – Tanabe– Sugano diagrams – uses. Electronicspectra of metal complexes – selection rules – group theoretical treatment of selection rules – relaxation of selection rules – electronic spectra bands – band intensities and widths - Jahn-Tellereffect – spectrochemical series – nephelauxetic series – calculation of **Dq**, **B'** and **β –** graphical method – Konig's numerical method **–** charge transfer spectra – spectra of lanthanides and actinides.

Unit-III NMR spectroscopy (15 hrs)

Nuclear magnetic resonance – chemical shift-reference compounds –interpreting chemical shift – spin –spin coupling. Aids in analyzing spectra-FTNMR-advantages- variable temperature NMR. Dynamic NMR spectra –. symmetrical two -site exchange – (slow/fast)-barrier to internal rotation-unsymmetrical site exchange – ring inversion – fluxional molecules –

fluorophosphoranes – organometallic compounds. NMR Spectra of other nuclei ^{13}C,^{19}F and ^{31}P applications to simple molecules.

Unit-IV ESR spectroscopy (15 hrs)

Electron spin resonance- principle-ESR transition -selection rules-g-factor-presentation of spectra-relaxation processes-hyperfine splitting-dipolar interaction-isotropic hyperfine interaction-spin polarization-hyperfine splitting constants-anisotropy in A and g- factor – dynamic processes-electron transfer-proton exchange-fluxional molecules. ESR of systems with more than one unpaired electron Triplet state-spin transition in triplet state-effect of dipolar field
– zero field splitting- Kramer's degeneracy-ESR of transition metal complexes-factors affecting g-value-effect of John-Teller distortion-spectra of 3d series metal ions.

Unit-V Mossbauer, NQR & PES (15 hrs)

Mossbauer spectroscopy- Principle – Recoilless transition – Effect of Magnetic field – Quadrupole nuclei – simple application to Iron and Tin complexes. Nuclear Quadrupole Resonance Spectroscopy: Introduction-quadrupole moment – electrical field gradient-asymmetryparameter-effect of external magnetic field-applications. Photo Electron Spectroscopy: UVPES and XPES Koopmann's theorem –ESCA - Auger effect- AES.

Text Books

I. *K.Veera Reddy, Symmetry and spectroscopy of molecules, Second revised edition, New Age International Publishers, 2009.*
II. *Russell.S.Drago, Physical Methods in Inorganic Chemistry, First edition, Affiliated East-West Press Private Ltd., 1965.*
III. *D.N.Sathyanarayana, Introduction to Magnetic Resonance Spectroscopy ESR, NMR, NQR, First edition, I. K. International Publishing House Pvt. Ltd., 2009.*
IV. *C.N.Banwell & Elaine McCash, Tata, Fundamentals of Molecular Spectroscopy, Fourth edition, McGraw- Hill Publishing Co.Ltd., 1994.*

Reference Book

1. *D.N.Sathyanarayana, Electronic Absorption Spectroscopy and Related Techniques, First edition, Universities Press (India) Ltd., 2001.*
2. *E.A.V.Ebsworth,David, W.H.Rankin, Structural Methods in Inorganic Chemistry, ELBS edition, Stephen Cradock, Blackwell Scientific Publications, 1988.*
3. *D.N.Sathyanarayana, , Vibrational Spectroscopy Theory and Applications, Second edition, New Age International Publishers 2004 (Reprint 2007).*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
III	MCHF183T20	Organic Spectroscopy	4	0	0	4

Aim:

- *To study the principles and applications of spectroscopic methods in structural elucidation of simple organic molecules*

Objective:

- *To impart the knowledge of structure elucidation of organic compounds using spectroscopic data.*

Outcome:

- *The students will acquire knowledge of using UV-Visible, IR, NMR and Mass spectral data for elucidating the structure of organic compounds.*

Unit-I UV-Vis spectroscopy (15 hrs)

Electronic transitions, red shift, blue shift – effects of solvents, calculation of λmax for isolated double bonds, conjugated double bonds, polyenes, carbonyl compounds (Woodward-Fieser rules), aromatic systems. Spectral problems.

Unit-II Infra-Red spectroscopy (15 hrs)

Absorption of IR radiation, Molecular vibrations (Vibrational motion is quantized, dipole moment and IR spectra, fundamental vibrations, symmetry and IR spectra, Overtones and combination bands, coupled vibrations, Fermi resonance), calculation of vibrational frequencies, Interpretation of IR spectra of alkanes, alkenes, alkynes, aromatic rings, alcohols, phenols, ethers, carbonyl compounds, aldehydes, ketones, carboxylic acids, esters, amides, acid chlorides, amines, nitro compounds. Spectral problems.

Unit-III H^1NMR & C^{13}NMR spectroscopy (15 hrs)

Introduction-chemical shift-TMS scale-spectrum-shielding effect and spin-spin splitting-theory of PMR-internal standard-factors affecting chemical shift-equivalent and non-equivalent protons-theory of spin-spin splitting-magnitude of coupling constant- 2D NMR – ROESY- COSY - NOE-NOESY-DOSY. Spectral problems. Introduction-spectrum-operating frequency-off resonance decoupling-chemical shift equivalence-chemical shifts. Spectral problems.

Unit-IV Mass spectrometry (15 hrs)

Introduction-EI ionization method-base peak-molecular ion peak-instrumentation-fragmentation pattern of general and simple organic molecules and derivatives.

Unit-V Combined spectral problems **(15 hrs)**

Combined spectral problems.

Text Books

I. *P.S. Kalsi, Spectroscopy of Organic Compounds, Fifth edition, New Age International Publishers, 2004.*
II. *Pavia, Lampman, Kriz, Vyvyan, Spectroscopy, Brooks/Cole, 2007.*

Reference Book

1 . *Silverstein, Bassler, Morrill, Spectrometric identification of organic compounds, John Wiley & Sons, 1991.*
2 . *William Kemp, Organic Spectroscopy, Palgrave, 1991.*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
III	MCHF183T30	Electrochemistry and Spectroscopy	4	0	0	4

Aim: *To understand the physical principles behind various spectral methods*

Objectives:

- *To study about the various theories of Electrolytic Conductance & Irreversible Electrode process.*
- *To study in detail Raman and electronic spectroscopies.*
- *To study in detail NMR and ESR spectroscopies.*

Outcome:

- *Students acquire Knowledge about Principles of Spectroscopy & about Irreversible electrode process*

Unit-I Theory of Electrolytic Conductance (15 hrs)

Degree of dissociation, ionic atmosphere, Debye-Huckel theory, mechanism of electrolytic conductance, DHO equation, validity of DHO eqn., deviations from DHO eqn., significance of degree of dissociation, determination of degree of dissociation, conductance ratio and DHO, Debye-Falkenhagen and Wien effects. Debye-Huckel limiting law, Debye-Huckel Bronsted equation, test for DH limiting eqn, extension of DH theory, triple ions (concept only).

Unit-II Electrified Interface (15 hrs)

Thermodynamics of electrified interface, Lippmann equation, electro-capillary curves, surface excess, determination of surface excess, structure of electrical double layer, Helmholtz-Perrin model, Gouy-Chapman model, Stern model. Electro-kinetic Phenomena, Zeta potential, electro-osmosis, streaming potential, electrophoresis, determination of zeta potential, effect of ions on electro-kinetic phenomena.

Unit-III Irreversible electrode processes & Electrodics (15 hrs)

Theories of overvoltage and its determination, factors affecting overvoltage, exchange current density, polarization.Irreversible electrode processes, polarography, theory and experimental set up, Ilkovic equation derivation, Halfwave potential, applications of polarography, amperometric titrations, kinetics of electrode reactions, Butler-Volmer equation derivation, Tafel equation, transfer coefficient (concept only).

Unit-IV Physical principles of spectroscopy, IR & Raman spectra (15 hrs)

EM radiation, quantization of energy, regions of spectrum, interaction of radiation with matter, representation of spectra, spectrometers, signal to noise ratio, resolving power, parameters for a spectral line (position, intensity, width), factors affecting them, FT spectroscopy, computer averaging.Infra red spectroscopy, the vibrating diatomic molecule, simple harmonic oscillator model, the anharmonic oscillator, diatomic vibrating rotator, break down of Born-Oppenheimer

approximation, vibrations of polyatomic molecules, overtones and combination frequencies, influence of rotation on the spectra of polyatomics, parallel and perpendicular vibrations, skeletal vibrations and group frequencies. Raman effect, classical and quantum theories, rotational raman spectra, symmetric tops and asymmetric tops, vibrational raman spectra, role of mutual exclusion, polarization of light and raman effect, combined use of raman and IR.

Unit-V Electronic and Spin Resonance Spectroscopies (15 hrs)

Electronic spectroscopy of molecules, Born-Oppenheimer approximation, vibrational coarse structure, progressions and sequences, Frank-Condon principle, dissociation energy, rotational fine structure, Fortrat diagram, pre-dissociation. NMR Spectroscopy: Interaction of spin and applied field, population of energy levels, Larmor precision, relaxation, FTNMR, multiple pulse FTNMR, NMR spectrum of hydrogen nuclei, chemical shift, coupling constant, Quadrupole effect. ESR Spectroscopy: Position of ESR absorption, hyperfine structure, fine structure of ESR spectrum, zero filed splitting, calculation of electron density.

Text Books

I. *Samuel Glasstone, An Introduction to Electrochemistry, First edition, Affiliated East West Press Private Ltd., 1942, reprint 1999.*
II. *J. N. Gurtu & A. Gurtu, Pragati Prakashan, Advanced Physical Chemistry, Eighth revised edition, 2006.*
III. *B.R. Puri, L.R. Sharma & Madan S. Pathania, Principles of Physical Chemistry, 37th edition, Shoban Lal Nagin Chand and Co., 1998.*
IV. *C. N. Banwell & Elaine McCash, Fundamentals of Molecular Spectroscopy, Fourth edition, Tata McGraw-Hill Publishing Co. Ltd., 1994, reprint 2001.*

Reference Books

1. *Skoog, Holler, and Crouch, Instrumental Analysis, Brooks/Cole, 2007.*
2. *H. Kaur, Pragati Prakashan, Instrumental Methods of Chemical Analysis, Sixth edition, 2010.*
3. *John.O.M Bockris and Amulya K.N Reddy, Modern Electrochemistry, Vol 1&2 ,Springer publications, 2008.*
4. *O.D. Tyagi & M. Yadav, A Text book of Spectroscopy, Anmol publications, 2002.*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
III	MCHF183T40	Organic Reagents & Reactions	4	0	0	4

Aim: *To enable the students to learn the principles of Photo chemical reactions and reagents used for various reactions*

Objective:

- *To impart the knowledge of Oxidation-reduction reactions are widely used to produce chemicals that are used in manufacturing*

Outcome:

- *Students get knowledge about organic compounds through the name reactions, oxidation and reduction reactions.*
- *To get an idea about terpenoids.*

Unit-I Oxidation reactions (15 hrs)

Mn(VII) oxidants: for the oxidation of alcohols, alkenes, alkynes, aromatic side chains and rings, aldehydes, ketones, amines, nitro, and carbonyl compounds. Oxidation by MnO_2. Cr (VI) oxidants: for the oxidation of alcohols, phenols- Jones reagent, Chromium trioxide-pyridine complex, pyridinium chlorochromate complex, pyridinium dichromate, Oxidation of alkanes, alkenes, and aromatic side chains and nucleus-catalytic asymmetric epoxidation, Swern oxidation,

Unit-II Reduction reactions (15 hrs)

Reduction using: Copper Chromite, $LiAlH_4$, Sodium borohydride, Sodium cyanoborohydride, Diborane, asymmetric reductions using Borane complexes Sodium/alcohol, Sodium/liq. NH_3, Magnesium, Zinc Chloride acid, Hydazine, Di-amide, Formic acid, silanes, stannous chloride, Sn/HCl, Zn/CH_3COOH, Zn/NaOH, Sodium metabisulphite, Sodium dithionite, Mg/alcoho,l.

Unit-III Organic name reactions (15 hrs)

Aldol condensation, Diels Alder reaction, Enamine reaction, Elbs persulfate oxidation, HVZ reaction, Perkin reaction, Riemer-Tiemann reaction, Rosenmund reaction, Wurtz reaction, Shapiro reaction, Robinson annulations, Chichibabin amination, MPV reduction.

Unit-IV Photochemical reactions (15 hrs)

Laws of photochemistry, electronic excitation, excited states, chemistry of excited molecules, difference between photochemical and thermal reactions, photochemical reactions of carbonyl compounds and olefins, photoisomerization of cis-trans stilbenes, photochemical cycloaddition reactions.

Unit-V Terpenoids (15 hrs)

Nomenclature-properties-isolation-isoprene rule-special isoprene rule-gem dialkyl rule-classification-general methods for structure determination-synthesis and structural determination of α pinene-camphor.

Text Books

I. *V.K. Ahluwalia, R.K. Parashar, Organic Reaction Mechanisms, Third edition, Narosa Publishing House, 2009.*
II. *P.S. Kalsi, Organic reactions and their mechanisms, Third edition, New Age International Publishers, 2010.*
III. *Gurdeep R. Chatwal, Organic Chemistry of Natural Products, Vol-I, Fifth edition, Himalaya Publishing Company, 2011.*
IV. *Gurdeep R. Chatwal, Organic Chemistry of Natural Products, Vol-II, Fifth edition, Himalaya Publishing Company, 2011.*

Reference Book

1. *I.L. Finar, Organic Chemistry, Vol I and II, Longman, 1963.*
2. *F.A. Cary and R.I. Sundberg Advanced Organic Chemistry, Part A & B, 5th Ed., Springer, 2009.*
3. *Laszlo Kurti, Barbara Czako, Strategic Applications of Named reactions in Organic Synthesis, Elsevier Academic press,2005.*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
III	MCHF183E50	Green Chemistry	4	0	0	4

Aim: *To make the students to understand, appreciate the practices and outcomes of green chemistry.*

Objectives:

- *To define "green chemistry" and place its birth and expansion in an historical context.*
- *To introduce the principles of green chemistry, outline examples, and establish the arguments for our need to recognize green criteria in the practice of chemistry.*
- *To present examples of successful green technologies.*

Outcome:

- *A functional understanding of the field of green chemistry.*
- *A working understanding of the twelve principles of green chemistry.*
- *An understanding of several real world examples where organizations used green chemistry to improve the sustainability performance of their products.*
- *An appreciation of how the practice of green chemistry enhances competitiveness, innovation and faster time to market.*

Unit-I Principles & Concept of green chemistry (15 Hours)

Introduction –Concept and Principles-development of Green Chemistry- Atom economy reactions –rearrangement reactions , addition reactions- atom uneconomic-sublimation elimination-Wittig reactions-toxicity measures- Need of Green Chemistry in our day to day life.

Unit-II Green Metrics - Measuring environmental performance (15 Hours)

Importance of measurement – lactic acid production-safer Gasoline – introduction to life cycle assessment-four stages of Life Cycle Assessment (LCA) –Carbon foot printing-green process Matrics-eco labels -Integrated Pollution and Prevention and Control (IPPC)-REACH(Registration, Evaluation, Authorization of Chemicals)

Unit-III Emerging green technology and alternative energy sources (15 Hours)

Design for Energy Efficiency-Photochemical reactions- Advantages-Challenge faced by photochemical process. Microwave technology on Chemistry- Microwave heating –Microwave assisted reactions-Sono chemistry and Green Chemistry –Electrochemical Synthesis-Examples of Electrochemical synthesis- Organic solvents – effects of solvents – Solvent less synthesis.

Unit-IV Renewable resources (15 Hours)

Biomass –Renewable energy – Fossil Fuels-Energy from Biomass-Solar Power- Other forms of renewable energy-Fuel Cells-Alternative Economics-Syngas economy- hydrogen economy-Bio refinery chemicals from fatty acids-Polymer from Renewable Resources –Some other natural chemical resources.

Unit-V Industrial case studies **(15 Hours)**

Methyl Methacrylate (MMA)-Greening of Acetic acid manufacture-Vitamin C-Leather manufacture –Types of Leather –Difference between Hide and Skin-Tanning –Reverse tanning –Vegetable tanning –Chrome Tanning-Fat liquoring –Dyeing –Application-Polyethylene- Ziegler Natta Catalysis-Metallocene Catalysis-Eco friendly Pesticides-Insecticides.

Text Books

I. *Lancaster, M. Green Chemistry: An Introductory Text; The Royal Society of Chemistry: 2002.*

II. *Anastas, P. T.; Warner, J. C. Green Chemistry: Theory and Practice; Oxford University Press,1998.*

III. *Manahan, S. E. Green Chemistry and the Ten Commandments of Sustainability; ChemChar Research Inc, 2005.*

IV. *J. Clark, D. Macquarrie, "Handbook of Green Chemistry & Technology", Blackwell Science, 2002*.

V. *Ahluwalia, V. K.; Kidwai, M. New Trends in Green Chemistry; Kluwer Academic:Dordrecht, The Netherlands, 2004.*

Reference Books

1. *Sheldon, R. A.; Arends, I.; Hanefeld, U. Green Chemistry and Catalysis; Wiley-VCH: Weinheim, 2007.*
2. *Renewable Resources: Scope and Modificaiton for Non-Food Applications; Stevens, C. Verhé, R. G., Eds.; John Wiley & Sons Ltd.: West Sussex, 2004.*
3. *Tundo, P.; Perosa, A.; Zecchini Methods and Reagents for Green Chemistry: An Introduction;, F., Eds.; John Wiley & Sons, Inc.: Hoboken, NJ, 2007.*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
III	MCHF183E60	Polymer Chemistry	4	0	0	4

Aim: *To understand the basic concepts of polymers*

Objectives:

- *To gain the knowledge in the preparation, properties, characterization and Uses of polymers.*
- *To Understand the industrial polymer processing techniques*

Outcome:

- *Students get knowledge about the various polymerization techniques.*
- *Learn about the applications of industrial oriented polymers.*

Unit-I Basic concepts of polymers (15 hrs)

Importance of polymers - Monomers - Degree of polymerization – Linear - Branched and Network polymers - Classification of polymers –Polymerization Methods: Condensation, Addition - Radical chain - Ionic and Co-ordination and Co-polymerization-Polymerization conditions and reactions- Polymerization in homogeneous and heterogeneous systems.

Unit-II Kinetics and Mechanisms (15 hrs)

Kinetics and mechanisms of Condensation, Addition - Radical chain - Ionic and Co-ordination-(Ziegler-Natta) polymerization and Co-polymerization.

Unit-III Polymer characterization (15 hrs)

Chemical analysis of polymers - Spectroscopic methods - X-ray diffraction studies - Thermal analysis - Physical testing: Tensile strength – Fatigue – Impact - Tear resistance - Hardness and Abrasion resistance. Polydispersion - Molecular weight: Number, Weight and Viscosity average molecular weights - Polydispersity and molecular weight distribution - Practical significance of molecular weight - Measurement of molecular-weights: End-group, Viscosity, Light scattering, Osmotic and Ultracentrifugation methods.

Unit-IV Polymer Structure and properties (15 hrs)

Molecular forces in polymers - dipole forces, induction forces, dispersion forces, Dependence of physical properties on intermolecular forces. Configuration of polymer chains – Crystal structure of polymers – morphology of crystalline polymers – structural requirements for crystallinity, degree of crystallinity, crystallizability-mechanism of crystallization– Crystalline melting point – glass transition temperature.

Unit-V Synthesis, Applications and polymer processing (15 hrs)

PE, PS, PMMA, PVA and PTFE -Polymer Processing: Molding – Compression – Injection – Blow – Thermoset – Extrusion – Brief Notes on Recent Advances in Polymers: Conducting Polymers - Polyaniline – Bio-degradable polymers –Polymer composites.

Text Books

I. *F.W. Billmeyer Jr., Wiley-India Textbook of Polymers Science, Second Edition, Wiley-India, 2007.*
II. *V.R. Gowarikar, N.V. Viswanathan, Jayadev Sreedhar, Polymer Science, First edition, New Age International (P) Ltd., Publishers, Reprint 2005.*
III. *Introduction to Polymer Chemistry, Charles E. Carraher. Jr., CRC Press, Taylor and Francis, 2006*

Reference Books

1. *M.S. Bhatnagar, A Text book of Polymer chemistry, S.Chand Publications, 2004.*
2. *B.K. Sharma, polymer Chemistry, Goel Publishing House, 2014*
3. *The Elements of Polymer Science and Engineering, Alfred Rudin, Elsevier Academic Press, 1999.*
4. *Polymer Science and Technology, Premamoy Ghosh, Tata MC Graw Hill, 2011.*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
III	MCHF183E70	Nanomaterials	4	0	0	4

Aim: *To study about nanoscience and nanotechnology*

Objectives:

- *To understand the basic concepts and chemistry of nanomaterials*
- *To familiarize with importance and applications of nanotechnology*

Outcome:

- *Students acquire basic knowledge on nanoscience*
- *They get an idea about the scope and importance of nanotechnology.*

Unit-I Introduction to Nanoscience (15 hrs)

The Science of Nano - Atomic structures - Molecular and atomic size - Bohr radius – Emergence of Nanotechnology – Differences between bulk and nanomaterials – Reasons - Challenges in Nanotechnology.

Unit-II Growth of Nanomaterials (15 hrs)

Influence of nucleation - rate on the size of the crystals - macroscopic to microscopic crystals and nanocrystals - large surface to volume ratio, top-down and bottom-up approaches - self-assembly process – template assisted and template free approach – micelles assisted methods - grain boundary volume in nanocrystals - defects in nanocrystals - surface effects on the properties.

Unit-III Types of Nanostructures (15 hrs)

Different types of nanomaterials - Types of Nanocrystals - One Dimensional (1D) - Two Dimensional (2D) -Three Dimensional (3D) nanostructured materials - Quantum dots - Quantum wire - Core/Shell nanostructures - Synthesis and properties of Carbon Nanotubes (CNT) and Graphene – Metal nanostructures of Au and Ag - Metal oxides (TiO_2, CeO_2, ZnO) - Semiconductors (Si, Ge, CdS, ZnSe) - Ceramics and Composites – Polymer nanocomposites.

Unit-IV Instrumentation Analysis for Nanomaterials (15 hrs)

Principle, Theory, Working and Applications of X-Ray Diffraction, Scanning Electron Microscopy, Transmission Electron Microscopy, High Resolution Transmission Electron Microscopy, Field Emission Scanning Electron Microscopy, Atomic Force Microscopy.

Unit-V Applications of Nanoscience and Nanotechnology (15 hrs)

Biological applications - Biochemical sensor - Nanoscience in Drug Delivery - Nanomedical applications of green nanotechnology - Membrane based water purification. Energy applications – Electrocatalysis – Nano Electronics and Nano Optics – Industrial Applications.

Text books:

I. *A.K.Bandyopadhyay, Nano Materials, New Age International, India, 2008.*
II. *K.K.Chattopadhyay, A.N.Banerjee Introduction to nanoscience & nanotechnology, PHI India, 2009.*
III. *T.Pradeep, Nano: the essentials understanding nanoscience & nanotechnology, Mcgraw-Hill Education India Pvt. Ltd, 2007.*
IV. *C.Carl, Koch, Nanostructured materials: Processing, properties & applications, William Andrew, NY, 2007.*

Reference books:

1. *M. Wilson, K. Kannangara, G Smith, M. Simmons, B. Raguse, Nanotechnology: Basic science and Emerging technologies, Overseas Press India Pvt Ltd, New Delhi, First Edition, 2005.*
2. *C.N.R. Rao, A. Muller, A. K. Cheetham (Eds), The chemistry of nanomaterials: Synthesis, properties and applications, Wiley VCH Verlag Gmbh&Co, Weinheim, 2004.*
3. *Kenneth J. Klabunde (Eds), Nanoscale Materials Science, John Wiley & Sons, InC, 2001.*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
III	MCHF183P80	Analytical Chemistry Laboratory	0	6	0	6

1. Estimation of $KMnO_4$ by Visible Spectrophotometery.
2. Estimation of Dye by Visible Spectrophotometery.
3. Estimation of Surfactant by UV-Visible Spectrophotometery.
4. Determination of Kinetics by UV-Visible Spectrophotometery.
5. Qualitative analysis of organics by FT-IR Spectrometer – KBr – technique.
6. Qualitative analysis of organics by FT-IR Spectrometer – ATR-technique.
7. Pot. Ferri cyanide and Ferro cyanide by Cyclic Voltammetry.
8. Electrochemical Oxidation of Organics by Cyclic Voltammetry.
9. Estimation of Fluorescence Dye by Spectrofluorometer.
10. Estimation of Quantum Yield by Spectrofluorometer.
11. Estimation of Alkali metals by Flame Photometry.
12. Determination of Reaction Kinetics by FT-IR spectrometer.
13. Analysis of water quality parameters.
14. Estimation of COD of waste water by spectrophotometer.

Reference Book

1. Course material developed by the department of chemistry, SCSVMV.

Scheme of Evaluation

S. No	Particulars	Max. Marks
1	Aim, Principle, Procedure, Model graph and Table	20
2	Graph	10
3	Calculation	10
4	Interpretation of result	10
5	Spectra Interpretation	30
6	Record	10
7	Viva-voce	10
Total		**100**

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
IV	MCHF184T20	Soft Skills and Scientific Writing	4	0	0	4

Aim: *To develop soft skills of students and to introduce about scientific literature to the students.*

Objective:

- *To impart the knowledge of soft skills, scientific literature survey and report writing.*

Outcome:

- *The students will acquire knowledge of time management, positive thinking and report writing*

Unit-I Memory and study skills (15 hrs)

Definition and importance of memory-Causes of forgetting-How to forget (thought stopping), how to remember (techniques for improving memory)-The technique of passing exams- management of examination fear.

Unit-II Power of positive thinking (15 hrs)

Nurturing creativity, decision-making and problem solving-Thinking power- seven steps for dealing with doubt-Traits of positive thinkers and high achievers-Goals and techniques forpositive thinking-Enhancement of concentration through positive thinking-Practicing a positive life style-Advantages of time management.

Unit-III Literature survey (15 hrs)

Chemical nomenclature and literature primary sources - secondary sources including reviews. Treatise and monographs, literature searching, Review of work relevant to the chosen problems. Abstraction of a research paper.

Unit- IV Writing a thesis or paper (15 hrs)

General format - page and chapter formation. The use of quotation - footnotes - tables and figures - referencing - appendixes - revising the paper or thesis - editing and evaluating the final product - proof reading the final typed copy - Publication of Research paper

Unit-V Oral presentation skills (15 hrs)

Structure, voice, appearance, body language – delivery Presentation a scientific seminar – appearing in interviews.

Text Books

I. *G.A. Dudley, Double your learning power,Thomas Publishing Group Ltd., Delhi, 2004.*
II. *J. Anderson, B.H. Dursten and M. Poole, Thesis and Assignment Writing, Wiley Eastern, 1977.*

Reference Books

1. *D.J. Mile, Power of positive thinking, Rohan Book Company, Delhi, 2004.*
2. *H. Lorayne, How to develop a super power memory, Thomas Publishing Group Ltd., 2004.*
3. *J. Anderson, B.H. Dursten and M. Poole, Thesis and Assignment Writing, Wiley Eastern, 1977.*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
IV	MCHF184T10	Surface Chemistry and Photo Chemistry	4	0	0	4

Aim:

- *To make the students to understand about the basics of surface chemistry and Photochemistry.*

Objectives:

- *To understand the concepts and applications of surface chemistry.*
- *To study about Photophysical Processes & Principles of Photochemistry*

OutCome:

- *Students acquire the knowledge about Catalytic reactions Which are used in day-to-daylife.*

Unit-I Adsorption (15 hrs)

Gas-Solid interface, types of adsorptions, factors affecting adsorption, physical adsorption, adsorption isotherms, Freundlich's adsorption isotherm, Langmuir adsorption isotherm, BET equation, modification of BET equation, determination of surface area, Harkins and Jura method, Benton and White method, point B method, importance of surface area, heat of adsorption.
Adsorption from solutions, types, Gibb's adsorption equation, verification of Gibbs equation, Domain & Barker method, tracer method, surface tension and surface free energy, capillary condensation, wetting phenomena, applications of adsorption.

Unit-II Reaction on Surfaces (15 hrs)

Mechanisms of surface reactions, effect of surface heterogeneity, unimolecular surface reactions, bi-molecular surface reactions, combination and formation of atoms at surfaces, exchange reactions, transition state theory of surface reactions, comparison of homogeneous and heterogeneous reaction rates. Classification of catalytic reactions, types of catalysts, metals, semi-conductors, insulators, energetic of adsorption processes.

Unit-III Colloids (15 hrs)

Emulsions, types, characteristics of emulsions, emulsifiers, theories of emulsification, importance of emulsion, micellar emulsion, applications, micelles, structure of micelles, ionic micelles, CMC, determination of CMC, solubilization, Donnan membrane equilibrium and its application. Applications of colloids.

Unit-IV Excitation of Molecules (15 hrs)

Mechanism of radiation absorption, electric dipole transitions, Einstein's treatment, intensity of electronic transitions, selection rules, directional nature of light absorption, life times of excited states, types of transitions, two photon absorption spectroscopy. Physical properties of excited molecules, changes on electronic excitation, potential energy diagram, shape of absorption band and Frank-Condon principle, emission spectra, environmental effect, dipole moment, acidity

constant, redox potential in excited states, geometry of electronically excited molecule, flash photolysis.

Unit-V Photophysical Processes (15 hrs)

Types of Photophysical pathways, Jablonski diagram, radiation less transition, internal conversion, intersystem crossing, fluorescence, phosphorescence, emission property and electronic configuration, kinetics of unimolecular processes, state diagram, delayed fluorescence,effect of temperature on emission processes. Kinetic collisions and optical collisions, mechanism of fluorescence quenching in gases, collisions in solution, Stern-Volmer equation, concentration dependence of quenching, excimer formation. Quenching by foreign substances, photosensitization, charge transfer mechanisms, energy transfer mechanism, donor acceptor interaction in energy transfer (qualitative treatment), sensitized delayed emission.

Text Books

I. *Gurdeep Raj, Advanced Physical Chemistry, 22nd edition, Goel Publications, 1998.*
II. *Keith J. Laidler, Chemical Kinetics, Third Edition, Pearson Education, 2004.*
III. *J. Rajaram, J.C. Kuriacose, Kinetics and Mechanisms of Chemical Transformations, First edition, Macmillan, 1993, reprint 2011.*
IV. *K.K. Rohatgi-Mukherjee, Fundamentals of Photochemistry, New Age International Publishers, 1978, revised edition 2002.*

Reference Book

1. *Peter Atkins, Julio de Paula, Physical Chemistry, Eighth edition, Oxford press, 2006.*
2. *Arthur W.Adamson & Aulice P. Gast, Physical Chemistry of Surface, Wiley India Pvt Ltd., 2012.*
3. *Gurudeep Raj, photochemistry, Krishna Prakashan publications,2012.*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
IV	MCHF184E40	Synthetic Organic Chemistry	4	0	0	4

Aim: *To teach the synthetic organic methodologies and reagents in organic synthesis*

Objective:

- *To impart the knowledge of multistep organic synthesis.*

Outcome:

- *Students get knowledge about the chemical modification of a functional group to obtain chemoselectivity in a subsequent chemical reaction.*
- *To get an idea about modern synthesis.*

Unit-I Heterocyclic compounds (15 hrs)

Chemistry of heterocyclic compounds, synthesis and reactivity of the following systems-quinoline, isoquinoline, benzofuran, benzothiophene, pyrazole, imidazole, oxazole, isoxazole, thiazole, isothiazole, pyridazine, pyrimidine, and pyrazine.

Unit-II Protecting groups and retero synthetic analysis (15 hrs)

Requirements for protecting groups-Protection and deprotection of hydroxyl, carboxyl, carbonyl, carboxy amino groups and carbon-carbon multiple bond; chemo- and regioselective protection and deprotection; illustration of protection and deprotection in synthesis.

Disconnection approach to synthesis – disconnection- definition – preferred positions – FGI – Synthons – synthetic equivalents – reterosynthetic analysis of Benzocaine, BHT and saccharine. Types of disconnections – order of disconnections - one group disconnections – RCO-X and ROH disconnections – two group C-X disconnections – types and examples only.

Unit-III Reagents in organic synthesis (15 hrs)

Preparation and reactions of: Aluminium isopropoxide, NBS, Diazomethane, DDQ, DCC, LTA, LAH, OsO_4, Sodium borohydride, Wittig reagent-hydroboration-oxidation-regio and stereo selectivity.

Unit-IV Modern synthetic methods (15 hrs)

Baylis-Hillman reaction, Henry reaction, Nef reaction, Kulinkovich reaction, Ritter reaction, Sakurai reaction, Tishchenko reaction and Ugi reaction. Brook rearrangement; Tebbe olefination. Metal mediated C-C and C-X coupling reactions: Heck, Stile, Suzuki, Negishi and Sonogashira.

Unit-V Pericyclic reactions (15 hrs)

Types of Pericyclic reactions, stereochemistry of Pericyclic reactions, M.O. theory, symmetry properties of reactant and product orbitals, 2+2 cycloadditions, 4+2 cycloadditions, cyclization of 4n systems, 4n+2 systems, correlation diagram, sigmatropic rearrangements.

Text Books

I. *V.K. Ahluwalia, R.K. Parashar, Organic Reaction Mechanisms, Third edition, Narosa Publishing House, 2009.*
II. *P.S. Kalsi, Organic reactions and their mechanisms, Third edition, New Age International Publishers, 2010.*
III. *F.A. Carey and R.I. Sundberg., Advanced Organic Chemistry, Part A & B, 5th Ed., Springer, 2009.*

Reference Book

1. *Jerry March., Advanced Organic Chemistry: Reactions, Mechanisms and Structure,Wiley Student Edition, 2006.*
2. *R.O.C. Norman and James.M. Coxon, Principles of Organic Synthesis, Modern synthesis,CRC press,1993*
3. *S.Warren,The Disconnection Approach, John Wiley & Sons, 2004.*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
IV	MCHF184E30	Nuclear and Bioinorganic Chemistry	4	0	0	4

Aim: *To study about basic concepts of nuclear chemistry and bioinorganic Chemistry*

Objectives*:*

- *To understand the basic concepts of nuclear reactions and nuclear reactor.*
- *To understand the biological importance of inorganic chemistry.*

Outcome:

- *Students will get an idea nuclear reactions and applications of inorganic compounds in biological systems.*

Unit-I Structure of nucleus (15 hrs)

size and shape of nucleus – nuclear stability - nuclear angular momentum – magnetic properties of nuclei – quadrupole moment –nuclear parity-forces and interactions.

Nuclear models: Shell, liquid drop and Fermi gas models – collective model –optical model. Detection and measurement of radioactivity: Radio activity – units of radio activity - characteristics of decay – decay kinetics – theories of alpha and beta decay (primitive treatment only) – gamma emission – artificial radio activity – detectors –ionization chamber scintillation and – semiconductor detectors.

Unit-II Nuclear reactions and applications (15 hrs)

Nuclear reactions: Bethe's notation – types of reactions –cross section- compounds nuclear theory – photo and thermo nuclear reactions – fusion reactors – origin and evolution of elements. Applications of radioactivity: Nuclear reactors – breeder reactor –India's nuclear energy – recovery of U and Pu from spent fuel – applications of radio isotopes – probing – Szilard-Chalmers' reaction – cow and milk systems –tracers. Elementary particles of nucleus: classification – particles and antiparticles – Parton structure –Quarks and Gluons – classification of Quarks – Higgs Boson.

Unit-III Bioinorganic Chemistry (15 hrs)

Metal ions in biological systems: Electron transfer systems –cytochrome and Fe –S proteins - Structure and functions -Transport and storage of oxygen – Haemoglobin –structure and functions –cyanide poisoning –Myoglobin-Chlorophyll – Cyanocobalamine- structure and functions-Calcium in biological systems –sodium-potassium ion pumps-Metals in medicine – Ptbinding to DNA.

Unit-IV Acids, Bases and Non-Aqueous Solvents (15 hrs)

Acids and Bases: Arrhenius theory –Bronsted –Lowry theory –Lux-Flood definition – Solvent system definition – Lewis concept – Usanovich definition – generalized acid base concept - HSAB concept – basis of classifications – applications – pi bonding contributions –electro negativity and hard soft species – limitations of the principle. Non aqueous solvents:

classification of solvents – leveling and differentiating solvents ionizing solvents –Liq.NH_3 – Liq.SO_2 - Liq.N_2O_4 - Liq. BrF_3 – acetic acid.

Unit-V Inorganic nomenclature and redox stability (15 hrs)

Affixes used in naming- general naming – names of ions- radicals –acids – salts and salt like compounds- boron hydrides-isopolyanions and heteropolyanions- organometallics

Redox stability in water – hydrogen over voltage – oxygen over voltage – Latimer, Frost and Pourbaix diagrams – Electrometallurgy - Ellingham diagram.

Text Books

I. *H.J.Arnikar., Essentials of nuclear chemistry, Revised Fourth edition, 1995, New Age International Publishers, Reprint 2009.*
II. *P.S.Kalsi and J.P.Kalsi., Bioorganic, Bioinorganic and Supramolecular chemistry, Fourth edition, New Age International Publishers, 2007.*
III. *R.Gopalan and V.Ramalingam. Concise coordination chemistry, First edition, 2001, Vikas Publishing House Private Ltd., Third reprint, 2007.*
IV. *Wahid U.Malik, G.D.Tuli and R.D.Mada.n, Selected Topics in Inorganic Chemistry, First edition, S.Chand and Company Ltd., 1976 (Reprint 1998).*
V. *F.Albert Cotton, Geoffrey Wilkinson, Carlos. A.Murilo and Manfred Bochmann., Advanced inorganic chemistry, Sixth edition, Wiley India, 2004 (Reprint 2008).*
VI. *G.S.Manku., Theoretical principles of Inorganic chemistry, First edition, Tata McGraw-Hill Publishing Company Ltd., 1980 (Twentieth reprint).*

Reference Books

1. *Bodie Douglas, Darl McDaniel and John Alexander., Concepts and Models of Inorganic Chemistry, Third edition, Wiley India Ltd., 2006.*
2. *Asim.K.Das., Bioinorganic Chemistry, First edition, Books and Allied (P) Ltd., 2007 (Reprint 2009).*
3. *M.Satake and Y.Mid., Bioinorganic Chemistry, First edition, Discovery Publishing House, 2001(Reprint 2003).*
4. *Stephen J. Lippard, Jeremy M. Principles of bioinorganic chemistry Berg.Mill Valley, Calif. University Science Books, 1994.*

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
IV	MCHF184E50	Supramolecular Chemistry	4	0	0	4

Aim: *To introduce and demonstrate the importance of supramolecular (non-covalent interactions) complex materials and applications.*

Objective: *To impart knowledge of types of supramolecules, structures their applications as organic materials, sensors, and devices.*

Outcome: *The students will acquire knowledge of,*

- *Molecular recognition and nature of bindings involved in biological systems*
- *Structure of supramolecules of various types in solution and solid state*
- *Applications of supramolecules in miniaturization of molecular devices*

Unit-I Supramolecular chemistry: Basic concepts, principles and history (15 hrs)
Introduction to Supramolecular chemistry- Basic concepts, principle and history. Nature of binding interactions in supramolecular structures: ion-ion, ion-dipole, dipole-dipole, H-bonding, cation-π, anion-π, π-π and vander waal interactions.

Unit-II Receptors: synthesis, structure and binding (15 hrs)
Synthesis and structures of crown ethers, Lariat ethers, Podands, Cryptands, Spherands, Calixarene, Cyclodextrins, Cyclophanes, Cryptophanes, Carcerands and hemicarcerands, Host-guest interactions, Preorganisation and complimentarity, Lock and key analogy. Binding of cationic, Anionic, Ion pair and neutral guest molecules.

Unit-III Self-assembly molecules (15 hrs)
Design, Synthesis and Properties of the molecules, Self-assembly by H-bonding, Catenanes, Rotaxanes, Dendrimers and Supramolecular gels. Relevance of supramolecular chemistry to mimic biological system.

Unit-IV Supramolecular Reactivity and Catalysis (15 hrs)
Catalysis by reactive macrocyclic cation receptor molecules. catalysis by reactive anion receptor molecules. catalysis with cyclophane type receptors. supramolecular metallocatalysis. cocatalysis: catalysis of synthetic reactions. biomolecular and abiotic catalysis.
Supramolecular chemistry in solution: cyclodextrin, micelles, dendrimmers, gelators. classification and typical reactions- applications.

Unit-V Supramolecular devices and sensors (15 hrs)
Various types of supramolecular devices, supramolecular light conversion and energy transfer devices. supramolecular electronic conducting devices - molecular wires, modified and switchable molecular wires. ion and molecule sensors.

Text Books

I. *Atwood, J., Steed, J., Supramolecular Chemistry - 2nd ed. Chichester: John Wiley & Sons, Ltd., 2009.*

II. *Hans-Joerg Schneider and Anatoly Yatsimirsky, Principles and Methods in Supramolecular Chemistry, J. Wiley and Sons; 1st Ed. 2000.*

III. *Kalsi, P.S., and Kalsi, J.P., Bioorganic, Bioinorganic and Supramolecular Chemistry, New Age International (P) Limited, Publishers, 2010.*

Reference Books

1 . Lehn, J. M., Supramolecular Chemistry-Concepts and Perspectives, Wiley –VCH, 1995.

2 . Beer, P.D., Gale, P. A., and Smith, D. K., Supramolecular Chemistry, Oxford University Press.1999.

3 . Steed, J. W., and Atwood, J. L., Supramolecular Chemistry, Wile, 2000.

4 . Kunitake, T., Ariga, K., Supramolecular Chemistry – Fundamentals and Applications. Advanced Textbook. Berlin: Springer-Verlag Heidelberg, 2006.

Semester	Sub. Code	Title of the Paper	L	P	T	Credits
IV	MCHF184E60	Crystal growth	4	0	0	4

Aim: *To create interest in the field of crystal growth techniques*

Objectives:

- *To study the Crystal Growth Theories.*
- *To understand the Characterization of Crystals.*

OutCome:

- *NLO organic single crystals have been identified as potential candidates in optical and electro-optical devices.*

Unit-I Nucleation (15 hrs)

Nucleation concept – Kinds of nucleation – Classical theory of nucleation - Spherical nucleus – Induction period – Measurement - Heterogeneous nucleation – Equilibrium concentration of embryos – Energy of formation of a critical nucleus - Free energy of formation of a critical heterogeneous cap shaped and disc shaped nuclei –Nucleation rate.

Unit-II Crystal Growth Theories (15 hrs)

Surface energy theory – Diffusion theory – Adsorption layer theory – Volmer theory –Bravais theory – Kossel theory – Two-dimensional nucleation theory – Free energy of formation of a two-dimensional nucleus – Possible shapes – Rate of nucleation.

Unit-III Crystal Growth Methods (15 hrs)

Growth from Melt, Vapor, Solution (High & Low Temperature Solution Growth). Low Temperature Solution Growth – Slow Cooling, slow Evaporation & Temperature Gradient Method.

Unit-IV Characterization of Crystals (15 hrs)

Different techniques for analysis - FTIR, UV as applied to solid crystals - Single Crystal XRD, SEM, NLO, Micro hardness. Principles of NLO -SHG. Steps in Crystal structure analysis

Unit-V Effects of impurities on crystals (15 hrs)

Doping,Types of Dopants-Imperfections due to doping – Thresholds concentration of doping in Crystals. Effect of doping on crystals. Methods of detecting imperfections.

Text books:

i. *Crystal growth for beginners, Ivan.V. Markov, World scientific Private Ltd.,2016.*
ii. *Introduction to crystal growth: Principles and practice, H. L. Bhat, CRC Press, 2014.*
iii. *Solid state chemistry, D.K.Chakrabarthy, New Age International Ltd, 2010.*
iv. *Solid state chemistry and its applications, Anthony.R. West, John Wiley& sons, 2014.*
v. *Introduction to Solid state physics, Neil W Ashcroft, N. David Mermin, Cengage Ltd, 2003.*

Reference books:

1. *Introduction to crystal growth, Klaus-Werner Benz, Wolfgang Neumann, Wiley-VCH, 2014.*
2. *Crystal Growth , Brain R. Pamplin., Pergamon Press. Oxford, 1980.*
3. *The growth of crystals from melt, Brice, J.C.. North Holland, Amsterdam, 1973.*
1. *Crystal Growth in Gels, Heinz K. Henish.. Cambridge University Press, 1973.*
2. *Cryst allization Mullin, J.W. Academic Press. London.1972.*

M.Phil. Chemistry

Syllabus

(With effect from the year 2018-2019)

Department of Chemistry

Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya

(University established under sec 3 of UGC Act 1956)

(Accredited with "A" by NAAC)

Enathur, Kanchipuram – 631 561.Tamilnadu,

M.Phil [Chemistry] – Curriculum & Syllabus

(With effect from 2018-2019)

Semester - I						
Subject Code	**Course title**	**Credits**	**Exam Duration**	**Marks**		**Total Marks**
MPCH181T10	Research Methodology	4	3	40	60	100
MPCH181T20	Physical methods in chemistry	4	3	40	60	100
	Dissertation oriented paper *(Any one of the following)*					
MPCH181T3A	1. Advanced electrochemistry	4	3	40	60	100
MPCH181T3B	2. Supramolecular chemistry	4	3	40	60	100
MPCH181T3C	3. Crystal growth	4	3	40	60	100
Semester - II						
MPCH182PZ0	Project - Dissertation	18	-	150		
	Project viva-voce		-	50		200
	Total Credits	**30**		**Total Marks**		**500**

Subject code	Course Title	L	T	P	Credits
MPCH181T10	Research Methodology	4	1	0	4

Aim:

To introduce the basic concepts of research, and methodology of research in science

Objectives:

- *Understanding the basics and methodology of research.*
- *Introducing the concepts of data analysis and importance of it.*

Outcome:

- *Sound understanding of concepts and methods of research*
- *Appreciation of utility of data analysis in research.*

Unit-I: Research methods (15 hours)

Identification of the Problem – Literature survey – Mode of approach of actual investigation — Drawing inferences from data - Qualitative and Quantitative analysis – Assessing the status of the problem – Results and Conclusions.

Unit-II: Survey of literature including patents (15 hours)

Chemical nomenclature and literature primary sources - secondary sources including reviews. Treatise and monographs, literature searching-Review of work relevant to the chosen problems. Abstraction of a research paper.

Unit-III: Introduction to Internet and its applications (15 hours)

Web browsers – World Wide Web –Search Engines – e-journals - literature Survey in Chemistry – Popular journals and websites in Chemistry – Databases in Chemistry - literature searching and collection using e-journals.

Unit-IV: Writing a thesis or paper (15 hours)

General format - page and chapter formation. The use of quotation - footnotes - tables and figures - referencing - appendixes - revising the paper or thesis - editing and evaluating the final product - proof reading the final typed copy - Publication of Research paper - Presenting in the seminar.

Unit-V: Errors in chemical analysis (15 hours)

Classification of errors – determination of accuracy of methods – improving accuracy of analysis – significant figures – mean, standard deviation – comparison of results : "t" test, "f" test and χ^2 test – rejection of results – presentation of data. Sampling – introduction – definitions – theory of sampling – techniques of sampling – statistical criteria of good sampling and required size .

Text Books

1. *Research Methodology, C.R.Kothari, New Age International Publishers,* ***2004****.*
2. *Research Methodology, R.Panneerselvam, Prentice Hall India Ltd,* ***2013.***
3. *Beyond Bullet Points, Atkinson, Prentice Hall India Ltd,* ***2012.***

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Reference Books

1. *Fundamental of Research Methodology and Statistics, Yogesh Kumar Singh, New Age International Publishers,* ***2006****.*
2. *Thesis and Assignment Writing, J. Anderson, B.H. Dursten and M. Poole, Wiley Eastern,* ***1977.***
3. *Introducing Research Methodology, Uwe Flick Sage Publications India Private Ltd,****2017***

Subject code	Course Title	L	T	P	Credits
MPCH181T20	Physical Methods in Chemistry	4	1	0	4

Aim: *To study about the principles and applications of physical methods of chemical analysis.*

Objectives:

- *To understand the theory and principles of various spectral methods for chemical characterization.*

Outcome:

- *A sound knowledge in spectroscopic methods and appreciation of the importance of spectroscopic methods*

Unit-I UV-Visible Spectroscopy (15 hours)

Electronic transition-chromophores and auxochromes-factors influencing position and intensity of absorption bands-absorption spectra of dienes, polyene and unsaturated carbonyl compounds-woodward Fieser rules –effect of solvent on spectra. IR Spectroscopy: Vibrational frequencies and factors affecting - identification of functional groups – intra and inter molecular hydrogen bonding –finger print region-far IR region.

Unit-II ^{1}H NMR Spectroscopy (15 hours)

^{1}H-NMR –introduction – number of signals- chemical shift – factors affecting chemical shifts –multiplicity of signals- coupling constants germinal and vicinal and long range coupling-factors affecting J value –simplification of complex spectra-introduction to FT NMR-pulse techniques- NOE- effect-chemical exchange -^{1}H-NMR spectra of some organic and inorganic molecules. ^{13}C NMR Spectroscopy: Introduction - decoupled and off resonance ^{13}C NMR Spectra-factors affecting ^{13}C chemical shifts –empirical calculation of chemical shifts-^{13}C NMR Spectra of some organic molecules.

Unit-III EPR Spectroscopy (15 hours)

Factors affecting the magnitudes of g and A tensors in metal species –zero field splitting and Kramer's degeneracy-spectra of V(II), Mn(II), Fe(II), Co(II), Ni(II) and Cu(II) complexes-Application of EPR to a few biological molecules containing Cu(II), Fe(II) and Fe(III) ions –densities and Mc Connel relationship-application of EPR to some simple system such as CH_3, p-benzoquinone.

Unit-IV Mass Spectroscopy (15 hours)

Principles – Instrumentation – Different ionizing techniques (EI,CI, FD, FAB, MALDI) - Various analyzers (Magnetic sector, Quadrupole, Ion trap, ToF) –Analysis of mass spectrum – simple cleavage - β cleavage - allylic cleavage – benzylic cleavage – Factors affecting fragmentation pathways - Mc-Lafferty rearrangement – ortho effect – Fragmentation patterns of common organic compounds.

Unit-V Electro-analytical techniques (15 hours)

Principle and applications of Electrogravimetry - Coulometric analysis - DC Polarography - Cyclic Voltametry - Stripping analysis.

Text Books

1. *Spectrometric Identification Organic Compounds, Silverstein and Webster, Wiley, **1998**.*
2. *Organic Spectroscopy, W. Kemp, ELBS, New Delhi, **1989**.*
3. *Physical Methods in Chemistry, R.S. Drago, W.B. Saunders Company, London, **1999**.*
4. *NMR, ESR and NQR spectroscopy Principles and Applications, D.N.Sathyanarayana, J.K international books, **2012**.*

Reference Books

1. *Applications of Absorption Spectroscopy of Organic Compounds, J.R. Dyer., Pretice - Hall,**1978**.*
2. *Introduction to Organic Spectroscopy, J.B. Lambert, H.F. Shurrell, A.P. Lightner, and R.G. Cooks, Macmillan, **1987.***
3. *Carbon-13 NMR Spectroscopy, J.B. Stothers, Academic press, **1972***
4. *Structural methods in inorganic chemistry, Ebsworth, Rankin and Craddock, ELBS,**1988**.*

Subject code	Course Title	L	T	P	Credits
MPCH181T3A	Advanced electrochemistry	4	1	0	4

Aim:

To introduce advanced and applied concepts of electrochemistry

Objective:

To impart knowledge about the electrified interfaces, methods to characterize them and their importance in energy conversion devices

Outcome:

The students will acquire knowledge of,

- *Basics about electrified interfaces and the kinetic and diffusion controlled process at them.*
- *Principles and applications of electro analytical techniques.*
- *Energy conversion devices, methods of conversions.*

Unit-I Electrodes and Ion transport in solution (15 hrs)

Electrode materials – electrode geometry – hydrodynamic conditions – chemically modified electrodes – microelectrodes- screen printed electrodes - electrode cleaning – reference electrodes –SHE - SCE-Ag,AgCl electrodes – double junction electrodes – Luggin capillary- ion selective electrodes

Introduction – diffusion – driving force of diffusion – Fick's law – diffusion coefficient – non-steady state diffusion – diffusion induced by a pulse – ionic drift under an electric filed – electro neutrality and conduction.

Unit-II Electrode processes (15 hrs)

Faradaic processes- electrified interfaces – double layer models – thickness of the double layer – thermodynamics of the electrochemical reactions-standard potential – formal potential.

Kinetics of electrodic reactions – electron transfer across the electrified interface – Butler-Volmer equation – Tafel equation- applications – equilibrium state for charge transfer – symmetry factor - equilibrium condition – kinetic and thermodynamic treatment-Nernst equation.

Unit-III Transient methods (15 hrs)

Voltammetry – Introduction – basic principles – cyclic voltammetry – reversible –quasi reversible and irreversible systems determination of redox state and number of electrons transferred - rotating disc electrode – Levich equation – ring disc electrode- Koutecky – Levich plot – Measurement of rate constants.

Linear Sweep Voltammtery – Randles-Sevick equation – effect of slow electron transfer –semiconducting electrodes – quantification of diffusion phenomena – mechanistic data from voltammetry.

Unit-IV Electrochemical energy conversion (15 hrs)

Introduction to fuel cells – brief history – efficiency of fuel cell – cold combustion – optimization of performance – power output of a fuel cell – porous electrode – types of fuel cells – alkaline fuel cell – phosphoric acid fuel cell – high temp. fuel cells – solid polymer electrolyte fuel cells – PEM fuel cell for automotives –general development of fuel cell based technology-the second fuel cell principle .

Unit-V (15 hrs)

1. Electrocatalysis for Polymer Electrolyte Fuel cells: from Fundamentals to Applications, Thomas J. Schmidt, ECS Trans. 2012, Volume 45, Issue 2, 3-14.
2. PEM fuel cell electrodes, S. Litster, G. McLean, Journal of Power Sources 130 (2004) 61–76
3. Platinum-Based Oxygen Reduction Electrocatalysts, Jianbo Wu and Hong Yang, Accounts Of Chemical Research,2013, Vol. 46, No. 8, 1848–1857
4. Tuning Nanoparticle Catalysis for the Oxygen Reduction Reaction, Shaojun Guo, Sen Zhang, and Shouheng Sun, Angewandte. Chemie, 2013, 52, 2 – 21
5. Electrocatalysts in the last 30 years – From Precious Metals To Cheaper But Sophisticated Complex Systems, Svetomir Hadži Jordanov, Perica Paunović, Orce Popovski, Aleksandar Dimitrov1, Dragan Slavkov, Bulletin of the Chemists and Technologists of Macedonia, Vol. 23, No. 2, pp. 101–112 (2004)

Text Books

1. *Modern Electrochemistry, John O'M. Bockris and Amulya K. N. Reddy and Maria Gamboa-Aldeco, Springer,**2009***
2. *Fundamentals of Electrochemistry, Paul Monk, John Wiley, **2001***
3. *Electroanalytical Methods- Guide to Experiments and Applications,(Ed) Fritz Scholz,Springer,**2010.***
4. *Analytical Electrochemistry, Joseph Wang, Wiley-VCH,**2000.***

Reference Books

1. *Electrochemistry, B.Viswanathan et al, Viswanathan, S., Printers & Publishers Pvt Ltd **2009.***
2. *Electrochemistry and Corrosion Science, Nestor Perez, Springer, **2016**.*

Subject code	Course Title	L	T	P	Credits
MPCH181T3B	Supramolecular Chemistry	4	1	0	4

Aim:

To introduce and demonstrate the importance of supramolecular (non-covalent interactions) complex materials and applications.

Objective:

To impart knowledge of types of supramolecules, structures their applications as organic materials, sensors, and devices.

Outcome:

The students will acquire knowledge of,

- *Molecular recognition and nature of bindings involved in biological systems*
- *Structure of supramolecules of various types in solution and solid state*
- *Applications of supramolecules in miniaturization of molecular devices*

Unit-I Supramolecular chemistry: Basic concepts, principles and history (15 hrs)

Introduction to Supramolecular chemistry- Basic concepts, principle and history. Nature of binding interactions in supramolecular structures: ion-ion, ion-dipole, dipole-dipole, H-bonding, cation-π, anion-π, π-π and vander waal interactions.

Unit-II Receptors: synthesis, structure and binding (15 hrs)

Synthesis and structures of crown ethers, Lariat ethers, Podands, Cryptands, Spherands, Calixarene, Cyclodextrins, Cyclophanes, Cryptophanes, Carcerands and hemicarcerands, Host-guest interactions, Preorganisation and complimentarity, Lock and key analogy. Binding of cationic, Anionic, Ion pair and neutral guest molecules.

Unit-III Self-assembly molecules (15 hrs)

Design, Synthesis and Properties of the molecules, Self assembly by H-bonding, Catenanes, Rotaxanes, Dendrimers and Supramolecular gels. Relevance of supramolecular chemistry to mimic biological system.

Unit-IV Supramolecular Reactivity and Catalysis (15 hrs)

Catalysis by reactive macrocyclic cation receptor molecules. catalysis by reactive anion receptor molecules. catalysis with cyclophane type receptors. supramolecular metallocatalysis. cocatalysis: catalysis of synthetic reactions. biomolecular and abiotic catalysis.
Supramolecular chemistry in solution: cyclodextrin, micelles, dendrimmers, gelators. classification and typical reactions- applications.

Unit-V Supramolecular devices and sensors (15 hrs)

Various types of supramolecular devices, supramolecular light conversion and energy transfer devices. supramolecular electronic conducting devices - molecular wires, modified and switchable molecular wires. ion and molecule sensors.

Text Books

1. *Supramolecular Chemistry, Steed, J. W., and Atwood, J. L, John Wiley & Sons, **2009**.*
2. *Supramolecular Chemistry - Fundamentals and Applications: Advanced Textbook. Kunitake, T., Ariga, KBerlin: Springer-Verlag Heidelberg, **2006.***
3. *Bioorganic, Bioinorganic and Supramolecular Chemistry , Kalsi, P.S., and Kalsi, J.P., , New Age International (P) Limited, Publishers, 2010.*

Reference Books

1. *Supramolecular Chemistry-Concepts and Perspectives Lehn, J. M., Wiley –VCH, **1995**.*
2. *Supramolecular Chemistry Beer, P.D., Gale, P. A., and Smith, D. K., Oxford University Press, **2009**.*
3. *Principles and Methods in Supramolecular Chemistry, Yatsimirsky, Hans-Joerg Schneider and Anatoly, J. Wiley and Sons, **2000**.*

Subject code	Course Title	L	T	P	Credits
MPCH181T3C	Crystal growth	4	1	0	4

Aim:

To introduce the basics of crystal growth mechanism, methods of growing and characterizing crystals.

Objective:

- *To study the Crystal Growth Theories.*
- *To understand the Characterization of Crystals.*

Outcome: *Realization of utility of crystal growth methods and of the crystals in various fields*

Unit-I Nucleation (15 hrs)

Nucleation concept – Kinds of nucleation – Classical theory of nucleation - Spherical nucleus – Induction period – Measurement - Heterogeneous nucleation – Equilibrium concentration of embryos – Energy of formation of a critical nucleus - Free energy of formation of a critical heterogeneous cap shaped and disc shaped nuclei –Nucleation rate.

Unit-II Crystal Growth Theories (15 hrs)

Surface energy theory – Diffusion theory – Adsorption layer theory – Volmer theory – Bravais theory – Kossel theory – Two dimensional nucleation theory – Free energy of formation of a two dimensional nucleus – Possible shapes – Rate of nucleation.

Unit-III Crystal Growth Methods (15 hrs)

Growth from Melt, Vapor, Solution (High & Low Temperature Solution Growth)-Low Temperature Solution Growth – Slow Cooling, slow Evaporation & Temperature Gradient Method.

Unit-IV Characterization of Crystals (15 hrs)

Different techniques for analysis - FTIR, UV as applied to crystals - Single Crystal XRD, SEM, NLO, Micro hardness-Principles of NLO –SHG-Steps in Crystal structure analysis.

Unit-V Effects of impurities on crystals (15 hrs)

Doping-Types of Dopants-Imperfections due to doping – Thresholds concentration of doping in Crystals-Effect of doping on crystals-Methods of detecting imperfections.

Text books:

1. *Crystal growth for beginners, Ivan.V. Markov, World scientific Private Ltd.,* ***2016.***
2. *Introduction to crystal growth: Principles and practice, H. L. Bhat, CRC Press,* ***2014.***
3. *Solid state chemistry, D.K.Chakrabarthy, New Age International Ltd,* ***2010.***
4. *Solid state chemistry and its applications, Anthony.R. West, John Wiley& sons,* ***2014.***
5. *Introduction to Solid state physics, Neil W Ashcroft, N. David Mermin, Cengage Ltd,* ***2003.***

Reference books:

1. *Introduction to crystal growth, Klaus-Werner Benz, Wolfgang Neumann, Wiley-VCH,* ***2014.***
2. *Crystal Growth, Brain R. Pamplin., Pergamon Press. Oxford.* ***1980****.*
3. *The growth of crystals from melt, Brice, J.C.. North Holland, Amsterdam.* ***1973.***
4. *Crystal Growth in Gels, Heinz K. Henish.. Cambridge University Press* ***1973****.*
5. *Crystallization Mullin, J.W. Academic Press. London.****1972***

Allied Chemistry

Syllabus for

B.Sc. [Physics & Mathematics]

(With effect from the year 2018-2019)

Department of Chemistry

Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya

(University established under sec 3 of UGC Act 1956)

(Accredited with "A" by NAAC)

Enathur, Kanchipuram – 631 561.Tamilnadu,

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
III	III	PH3C4	Fundamentals of Chemistry-I	3	0	1	3

Aim: *To learn about the chemical bonding and fundamentals of chemistry*

Objective:

- *To learn the basic of bonding nature, mechanism of reactions and materials used in the industries.*

Outcome:

- *Understanding on various bonding types in chemical compounds.*
- *Understanding on nuclear reactions and reaction mechanism in chemistry.*

Unit-I Chemical Bonding – I (12 hrs)

Types of bonds – ionic bond- factors favoring ionic bond - covalent bond – orbital overlap – linear combination of orbitals - σ and π bond formation – polarity in covalent molecules - Fajan'srule – effects of polarization -coordinate bond - simple examples.Molecular Orbital Theory – linear combination of orbitals –types of molecular orbitals- energy level diagrams- e^- filling in MO – bond order – MO diagrams of H_2, He_2, Li_2, Be_2, N_2 and O_2 molecules – mixing of orbitals – MO diagrams of CO, HF and NO molecules. Metallic Bond – properties of metals – free electron theory – merits and demerits – valence theory - band theory of solids (Primitivetreatment only) – H-bonding – effects H bonding.

Unit-II Co-ordination Chemistry (12 hrs)

Co-ordination chemistry-definition of terms- classification of ligands-Nomenclature- Chelation-Examples. Chelate effect- explanation-Coordination chemistry -nomenclature of complexes - Werner, Sidgewick and Pauling theories–Chelation – examples of complexes- Prussian Blue, Haemoglobin , Chlorophyll -applications of coordination chemistry in qualitative and quantitative analysis.

Unit-III Fundamentals of reaction mechanism (12 hrs)

Homolytic and heterolytic fissions – types of organic reactions – types of attacking reagents – inductive, electromeric, resonance and hyperconjugation effects. Types of substitution reactions – $S_N1$and S_N2 reactions – aromatic electrophilic substitution mechanism – Mechanism of nitration, halogenation, alkylation, acylation, sulphonation – elimination reactions – mechanism, examples. Addition reactions – types – nucleophilic and electrophilic additions-nucleophilic additions to alkenes – Markovnikov rule – peroxide effect.

UNIT-IV Photochemistry and Electrochemistry (12 hrs)

Photo chemistry – Grotthus-Drapers law and Stark-Einstein's law of photochemical equivalence. Quantum yield. Examples for photochemical reactions-Hydrogen- Chlorine reaction, photosynthesis. Phosphorescence, Fluorescence, Chemiluminesence and photosensitization - definitions with examples.

Electrochemistry: Ionic equilibria- strong and weak electrolytes, acid-base, common ion effect, pH, buffer solutions and buffer action in biological systems and salt hydrolysis. (Definitions, examples and equations only). (No derivations)

Unit-V Industrial chemistry (12 hrs)

Dyes – theory of colour and constitution - chromophore, auxochrome- classification of dyes – natural dyes (Indigo) – azo dyes (Methyl Orange, Bismark brown) – triphenyl methane dyes (Malachite Green, Crystal violet). Polymers- types- addition polymerization – mechanisms- preparation, properties and uses of PE,PU, PMMA and SBR.Fertilizers - micro and macro nutrients - urea, ammonium sulphate, ammonium nitrate, potassium nitrate NPK fertilizer – eutrophication- organic manures – compost, vermiculate.

Text Books:

1. Puri & Sharma – Principles of Physical Chemistry- Vishal Publishing Co, 42nd Edition, (2007).
2. Bahl & Arun Bahl,Principles of Organic Chemistry - S. Chand & Company, 16th edition, (2004).
3. Gopalan, R., Ramalingam, V. Concise Coordination Chemistry, Vikas Publishing House Pvt. Ltd. (2007).

Reference Books:

1. Jain & Jain –Dhanpat, Engineering Chemistry –Rai Publishing, 15th edition, (2008).
2. Asim. K.Das, Fundamental concept of Inorganic Chemistry –CBS publishers and Distributors, 2nd edition, (2010).
3. B.K. Sharma – Industrial Chemistry –Krishna Prakashan media (p) Ltd., 8th edition, (1996).

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
IV	III	PH4C4	Fundamentals of Chemistry-II	3	0	1	3

Aim: *To learn about kinetics of reaction, stereoisomerism and biomolecules*

Objective:

- *To learn the basic concept of kinetics, liquid state, solutions and medicinal compounds in chemistry.*

Outcome:

- *Understanding on rate of reaction and naming reaction in chemistry*
- *Understanding on various biomolecules in chemistry.*

Unit-I Liquid state and solutions (12 hrs)

General properties of liquids – vapour pressure- definition, measurement – Trouton's rule – surface tension – effect of T on surface tension – effects of surface tension – measurement – surfactants – viscosity- measurement of viscosity – effect of temperature, pressure on viscosity.Solutions - types - Liquid in Liquid - Raoult's law. Deviation from ideal behavior - Binary liquid mixtures- theory of fractional distillation – azeotropes. Mesomorphic state – compounds forming liquid crystals – types of liquid crystals – applications of liquid crystals.

Unit-II Chemical kinetics and catalysis (12 hrs)

Kinetics – terminology of kinetics - rate, law of mass action, rate law, order, molecularity, pseudo first order, half-life period -Determination of order – graphical, isolation and half-life time methods. Kinetics of zero, first and second order reactions (both cases) – kinetics of hydrolysis of ester (both acid and alkaline)activation energy – importance of E_a – Arrhenius equation (derivation not expected) .

Catalysis – requirements of a catalyst – types of catalysis and catalysts –theories of catalysis – enzyme catalysis –Fischer mechanism.

Unit-III Stereoisomerism and Name reactions (12 hrs)

Stereoisomerism – types – geometrical isomerism – optical activity- condition for optical activity – symmetry elements –chirality -optical isomerism –R,S notation - disastereomers – optical activity of lactic and tartaric acids- racemization.Name reactions - Mechanisms of aldol, Schmidt, Perkin, Knoevenagel, Cannizaro and benzoin condensation reactions.

Unit-IV Biomolecules (12 hrs)

Amino Acids- Classification – preparation, properties - preparation of peptides. Classification of proteins - Primary and secondary structures of proteins – biosynthesis of proteins (basic idea only) Carbohydartes – classification, preparation and properties of glucose and fructose- open ring structuresof glucose and fructose. Antineoplastic agents – cancer – types of tumour – causes for cancer – treatment methods (concepts only)-antineoplatic agents- alkaylating agents – cisplatin - mode of action.

Unit-V Industrial materials **(12hrs)**

Lubricants – friction and wear – functions and types of lubricants –mechanism of lubrication – solid lubricants – selection of lubricants –cutting fluids. Adhesives – adhesive action- factors affecting the adhesion- classification of adhesives.Cement – manufacture of Portland cement – hardening of cement – Glass- manufacture – types (Soda –lime and Potash – lime glasses only) and their uses.

Text Books:

1. Puri & Sharma – Principles of Physical Chemistry- Vishal Publishing Co, 42nd Edition, (2007).
2. Bahl & Arun Bahl, Principles of Organic Chemistry - S. Chand & Company, 16th edition, (2004).
3. V.K.Ahluwalia, Drugs, Ane Books Pvt. Ltd. (2010).

Reference Books:

1. Jain & Jain –Dhanpat, Engineering Chemistry –Rai Publishing, 15th edition, (2008).
2. Asim. K.Das, Fundamental concept of Inorganic Chemistry –CBS publishers and Distributors, 2nd edition, (2010).
3. B.K. Sharma – Industrial Chemistry –Krishna Prakashan media (p) Ltd., 8th edition, (1996).

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
IV	III	PH4LC2	Fundamentals of Chemistry Laboratory	0	3	0	2

ALLIED CHEMISTRY PRACTICALS

I. VOLUMETRIC ANALYSIS: (any 10)

1. Estimation of hydrochloric acid using standard Oxalic acid.
2. Estimation of Sodium hydroxide using standard Sodium carbonate
3. Estimation of Na_2CO_3 in washing soda
4. Estimation of Carbonate and bicarbonate in a mixture
5. Estimation of Ferrous Sulphate- standard Mohr's salt solution.
6. Estimation of Oxalic acid- standard Mohr's salt solution
7. Estimation of H_2O_2 – using standard oxalic acid
8. Estimation of MnO_2 in Pyrolusite
9. Estimation of Cu^{2+} by using standard $K_2Cr_2O_7$
10. Estimation of Cu^{2+} by using standard $CuSO_4$
11. Estimation of Chloride ion in water
12. Estimation of hardness of water using EDTA.

II. ORGANIC ANALYSIS: systematic analysis

1. Detection of Elements (N, S, Halogens).
2. To distinguish between Aliphatic and Aromatic.
3. To distinguish between saturated and unsaturated.
4. (a) Functional group tests for phenols, acids (mono and di), aromatic primary amine, amide, diamide, carbohydrate, carbonyl compounds.
   (b) Functional group(s) to be characterized by confirmatory tests.

Reference Books:

1. Advanced Inorganic Practicals- Gurudeepraj , Krishnaprakasham , 2nd edition, 2002.
2. Systematic Orangic Analysis, Gnanaprakasham, B.Viswanathan publishers, 1st edition, 1979.

Scheme of Valuation	
Record	**10 marks**
Volumetry	**40 marks**
Aim,Tables (05 marks)	
Procedure (10 marks)	
Calculation (15 marks)	
Result (10 marks)	
Organic Analysis	**40 marks**
Procedure (15 marks)	
Elements (05 marks)	
Aromatic/ Aliphatic (05 marks)	
Sat/Unsat (05 marks)	
Functional group (10 marks)	
Viva	**10 marks**
Total	**100 marks**

Engineering Chemistry

Syllabus

(With effect from the year 2018-2019)

Department of Chemistry

Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya

(University established under sec 3 of UGC Act 1956)

(Accredited with "A" by NAAC)

Enathur, Kanchipuram – 631 561.Tamilnadu,

I B.E./ B.Tech Engineering Chemistry Syllabus (with effect from 2018-19 onwards)

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
I / II		CBSCH18T20	Engineering Chemistry (Chemistry – I)	3	0	1	4

Aim: *Making the students to realize the importance and utility of chemistry in various fields*

Objective:

- *To learn the basics of atomic structure, bonding, analytical methods and various types of reactions in organic chemistry.*

Outcome:

The students will be able to

- Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalize bulk properties and processes using thermodynamic considerations
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
- Rationalize periodic properties.
- List major chemical reactions that are used in the synthesis of various organic molecules.

Unit I: Atomic structure (15 Lectures)

Comparison between Rutherford's model of atom and Bohr's model - Bohr-Sommerfeld model (Concepts only)-its limitations - de Broglie theory-Heisenberg's uncertainty principle - Schrodinger's wave equation (derivation not needed)-significance of Ψ and Ψ^2 – shapes of different orbital's –Aufbau principle-Pauli Exclusion Principle- Hund's rule. Electronic configuration of atoms- Mosley's law – Modern periodic table - periodic properties: atomic size- ionization energies- electron affinity- electro negativity.

Unit II: Chemical Bonding **(**15 Lectures)

Types of bonds – ionic - covalent – coordinate bond - Molecular Orbital Theory –types of molecular orbitals- energy level diagrams- e^-ns filling in MO – bond order – MO diagrams of H_2, He_2, N_2, O_2, CO and HF molecules**–**Metallic bond – band theory of solids (primitive treatment only) and the role of doping on band structures - Hybridization – definition - geometry of the molecules- CH_4, C_2H_4, C_2H_2 - Molecular forces-Ionic, dipolar, van der waals interactions.

Unit III: Thermal and electrochemical equilibria (15 Lectures)

Thermodynamic functions: State functions, Path functions, Internal energy, enthalpy, entropy and free energy-Gibbs Helmholtz equation and its applications. Feasibility of reaction - Ellingham diagrams.

Types of electrodes- Standard electrodes-Standard hydrogen electrode, standard calomel electrode, Single electrode potential , electrochemical series - galvanic cell - emf - Nernst equation and its applications - Glass electrode, Potentiometric acid base titrations and Solubility equilibria-Corrosion-types-Chemical corrosion-electrochemical corrosion-factors influencing and control measures.

Unit IV: Spectroscopic techniques and applications (15 Lectures)

Electromagnetic radiations – wavelength – frequency – energy of a radiation – electromagnetic spectrum – changes brought about by the radiations– components of a spectrometer – rotational spectra of

diatomic molecules – rigid and non-rigid rotor models (energy expressions only)- selection rule– schematic instrumentation – types of vibrations in molecules (CO_2, H_2O) – vibrational spectra (primitive treatment) – selection rule- instrumentation and applications – electronic transitions – electronic spectra — Beer-Lambert's law- instrumentation and applications – NMR – principle – chemical shift - instrumentation – NMR spectra of CH_4 – CH_3OH – xylene isomers – MRI (Introduction only)

Unit V: Stereochemistry & Organic Reactions (15 Lectures)

Stereochemistry - Representation of 3D structures - Fisher projection, Newman and Sawhorse projection formulae – Ethane, 3-bromo-2-butanol Conformation of Ethane, Butane & Ethylene glycol, , Symmetry and Chirality - Stereo isomers, Enantiomers, Diastereomers. Configuration - R-S system. Optical activity - Lactic acid, Tartaric acid- Geometrical isomerism – *cis-trans* & E-Z notations.

Organic Reactions – Substitution - S_N^1 & S_N^2 (simple examples, mechanism not expected) – electrophilic substitutions – Friedel Crafts alkylations - Additions – 1,2-addition **–** types- addition of HX - Elimination – E^1 & E^2 (Examples only, mechanism not expected) - Oxidations – *cis*-hydroxylation with OsO_4, Reductions – Clemmensen & wolff-Kishner reductions, Cyclization – Diels Alder, Ring-Opening – Nylon-6 from caprolactum.

Synthesis of most commonly used drugs – Aspirin, Paracetamol.

Text Books

1. Textbook of Inorganic Chemistry, P.L.Soni, Sultan Chand & Sons, Delhi, 2013. (For units I and II)
2. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma and Madan S. Pathania, Shoban Lal Nagin Chand & Co., Jalandhar, 2000. (For units III and IV)
3. Advanced Organic Chemistry, B. S. Bahl and Arun Bahl, S.Chand, Delhi, 2012. (For unitV).

Reference Books

1. Engineering Chemistry, P.C. Jain and Monika Jain, Dhanpat Rai Publishing Co Pvt. Ltd., New Delhi, 2008.
2. Applied Chemistry, K. Sivakumar, Anuradha Publications, Chennai, 2009.
3. Textbook of Engineering Chemistry, S.S.Dara & S.S. Umare, S.Chand, Delhi, 2004.
4. Fundamentals of Molecular Spectroscopy, C.N.Banwell and Elaine.M.McCash, 4th Edition, McGraw Hill Education, 2017.
5. Physical Chemistry, P. W. Atkins and Julio De Paula, 10th Edition, Oxford University Press,2014.

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Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
I / II		CBSCH18P60	Chemistry Lab	0	3	0	1.5

Aim: *To make the students familiar with the way of systematic experimenting in the laboratory*

Objective:

- *To learn the basics and perform experiments involving volumetric analysis, colligative properties, simple synthesis and other instrumental techniques.*

.***Outcome:***

After the course the students will be able to

- Estimate rate constants of reactions from concentration of reactants/products as a function of time .
- Measure molecular/system properties such as surface tension, viscosity, Conductance of solutions, redox potentials, chloride content of water.
- Synthesize a small drug molecule
- Analyze a salt sample

Any ten experiments of the following

1. Determination of surface tension and viscosity of a liquid or a solution
2. Thin layer chromatography / Paper chromatography for separation of a mixture.
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water by volumetry.
5. Determination of M.wt of a non-volatile solute by Rast's method.
6. Determination of the rate constant of the reaction between $K_2S_2O_8$ and KI – Clock reaction method.
7. Conductometry -Verification of Debye-Huckel-Onsager equation for a strong electrolyte.
8. Potentiometry - Determination of formal redox potential of Fe^{3+}/Fe^{2+} couple
9. Synthesis of Nylon 66 by interfacial polymerization method.
10. Determination of Saponification/acid value of oil.
11. Systematic qualitative analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces – computational experiment.
14. Chemical oscillations- Potentiometric study of the oscillations of Belousov-Zhabotinsky reaction
15. Determination of the partition coefficient of I_2 between water and CCl_4
16. Verification of Freundlich isotherm for adsorption of acetic acid / oxalic acid by charcoal.
17. Determination of isoelectric point of Gelatin sols by using capillary viscosmeter.

Text Books

1. Advanced Practical Physical Chemistry, J.B.Yadhav, Krishna Prakasan Media, 2016.
2. Experiments in Applied Chemistry, Sunita Rattan, S.K. Kataria& Sons, 2012.

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Environmental Science

Syllabus for all UG Programme

(With effect from the year 2018-2019)

Department of Chemistry

Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya

(University established under sec 3 of UGC Act 1956)

(Accredited with "A" by NAAC)

Enathur, Kanchipuram – 631 561.Tamilnadu,

Semester	Branch	Sub. Code	Title of the Paper	L	P	T	Credits
I	B.Sc.Mathematics	UM105	Principles of Environmental Science	3	-	1	4
I	B.Sc.Chemistry	BCHF181T40	Principles of Environmental Science	3	-	1	4
I	B.Sc.Physics	PH1P5	Principles of Environmental Science	3	-	1	4
III	B.Sc.Comp.Sci	BS307	Basics of Environmental Science	3	-	1	4
I	B.A. English	BENF171T50	Environmental Studies	3	-	1	4
I	B.A. Sanskrit	SA303	Principles of Environmental Science	3	-	1	4
II	B.Com	BC206	Principles of Environmental Science	3	-	1	4
II	B.B.A	BB206	Principles of Environmental Science	3	-	1	4
III	B.C.A	CC308	Basics of Environmental Science	3	-	1	4
II	BE/B.Tech	CMCCH28T50	Environmental Science and Engineering	2	-	-	1

Aim:

- *To understand about our environment.*

Objectives:

- *To familiarize the students with basic concepts of environment and creating awareness.*
- *To understand their role and responsibility of an individual in the environmental conservation.*

Outcome:

- *Students are expected to be aware about the environment and pollution problems.*

Unit - 1: Introduction to environment and environmental studies (15 hrs)

1.1. Introduction to environment – components – nature of environment - need of awareness – reasons for environmental problems – anthropocentric and eco centric views.
1.2. Environmental studies - multidisciplinary nature – scope and aim – sustainabledevelopment-principles – RRR concept-Indian environmental movements – environmental calendar.

Unit – 2: Ecosystem and Biodiversity (15 hrs)

2.1. Ecosystem – structure – functions – simplified ecosystem models (food chain and food webs and their types, energy flow) - forest – grassland – pond –ecosystems – ecological succession - ecological pyramids – Bio-geochemical cycles of water – oxygen-carbon-phosphorous and sulphur.
2.2. Biodiversity – definition – types – species – genetic and ecosystem diversities- values of biodiversity – threats to biodiversity – conservation of biodiversity – endemism – biodiversity hotspots – Indian biodiversity– endemic species of India – IUCN lists -red-green and blue data books.

Unit – 3: Natural resources (15 hrs)

3.1 Natural resources – definition – types – forest resources – uses –deforestation- reasons - effects

–water resources – dams – effects of dams - food resources – modern agriculture– ill effects - energy resources- types – hydel –nuclear – solar –wind and biomass energy - world scenario – Indian scenario.

3.2 Population and environment – reasons for over exploitation of resources – population – demography – population curves – population explosion – effects – consumerism – effects – urbanization – reasons and effects- role of an individual.

Unit – 4: Environmental Pollution (15 hrs)

4.1 Pollution – definition – types – air pollution – causes and effects – effects of CO_2 – CO – NOx –SOx – particulates – control of air pollution – water pollution – causes – effects – remedies – soil pollution – solid waste management – e waste – ill effects of e-waste – proper recycling- Noise pollution – reasons – effects – control – nuclear pollution – cases – effects and control –thermal pollution causes – effects and remedies.

4.2 Legal provisions for protecting environment – article 48 A – 51 A (g) – Environment act 1986 – Air act 1981 – Water act 1974 – wild life protection act – Forest act 1980- problems in implementation–reasons.

Unit – 5: Social issues and environmental ethics (15 hrs)

5.1 Present environmental scenario – greenhouse effect – climate change – The Kyoto Protocol – ozone layer depletion-The Montreal Protocol - acid rain – causes – effects - disparity among the nations – The Copenhagen UNFCCC summit – carbon currency- virtual water- genetically modified organisms, Disaster management.

5.2 Environmental ethics – introduction – people getting affected - resettlement andrehabilitation – issues involved –Sardhar Sarovar project – Tawa Matsya sang - Melting icebergsof Arctic.

Text Book

Anubha Kaushik and C.P. Kaushik," Prospects of Environmental Science", New AgeInternational publishers, 2013.

Reference books

1. Environmental Studies, N. Nandini, N. Sunitha and Sucharita Tandon, Sapna Book House,2007.
2. Text book of Environmental Science, Ragavan Nambiar, Scitech Publications, 2009.
3. Text book of Environmental Chemistry and Pollution Control, S.S.Dara, S.Chand and Co.,2002.
4. Environmental Chemistry, Colin Baird, W.H.Freeman and company, New York,1999.
5. Environmental Chemistry, Gary W. VanLoon and Stephen J.Duffy, Oxford UniversityPress, 2000.
6. New Trends in Green Chemistry, V.K. Ahluwalia and M. Kidwai, Anamaya Publishers,2006.

Open Elective

Syllabus

(With effect from the year 2018-2019)

Department of Chemistry

Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya

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Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
III		OE3BI	Basics of Bioinformatics	2	-	-	1

Aim: *To gain introductory knowledge about bioinformatics.*

Objectives:

- *To know the fundamentals of biological databases.*
- *To know the different levels of protein structure*

Outcome:

- *To gain knowledge about the biological databases and structure of DNA and protein.*

Unit-I: DNA and protein databases

Understanding DNA and protein sequences – DNA and protein databases – preliminary level analysis of DNA and protein sequences using bioinformatics tools. Examples of related tools (FASTA, BLAST), databases (GENBANK, PUBMED, PDB) and softwares(RASMOL,Ligand Explorer). Applications of Bioinformatics.

Unit-II: Protein structural databases

Biological Database and its Types Introduction to data types and Source. General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDBsum)

Unit-III : Protein structure

Protein Structure: Primary, Secondary, Tertiary, Quaternary, Ramachandran plot.

Text Books:

1. Introduction to Bioinformatics, Attwood, P.Smith, Benjamin Cummings, 2001.
2. Introduction to Bioinformatics, Arthur M. Lesk, OUP Oxford, 2013

Reference Books:

1. Bioinformatics - A Beginners Guide. Jean-Michel Claverie, Cedric Notredame, WILEY. 2003.
2. Essential Bioinformatics, Jin Xiong, Cambridge University Press, 2006.

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
III		OE3CI	Chemistry in crime investigation	2	-	-	1

Aim: *Understanding the basics of forensic science and analytical methods employed in it.*

Objectives:

- *To introduce the time-line and basics of forensic science.*
- *To understand the basics of physical and trace evidence processing.*

Outcome:

- *Realization of the importance of forensics in scientific way of solving a crime.*

Unit-I Basics of forensic science

Introduction to forensic science – time line of forensics – divisions of forensics – latest techniques used.

CSI – crime scene – Locard's principle – limitations – preservation of crime scene – recording the scene – forensic photography - search patterns – value of trace evidences – list of possible trace evidences.

Unit-II Physical & trace evidences

Finger prints –individuality –pattern classification – latent prints – developing the latent prints – chemical and physical methods – foot prints – location and preservation- collection of foot prints – Gait pattern – deductions from walking pattern.

Trace evidences – hairs – fibers – blood – semen – soil – dirt – tyre marks- skid marks- glass – paints.

Unit-III Forensic toxicology and document study

Forged documents – types of forgery - detection - counterfeit currencies – hand writing analysis – factors affecting hand writing – erasures- alterations – additions – obliterations – order of writing – age of writing. Forensic toxicology – alcohol – blood alcohol level- drugs – narcotics – poisons – toxins – methods of identifications. Arson cases- detection of residual fuel – firing pattern analysis.

Text Books:

1. Forensic Science in Crime Investigation – B.S. Nabar – 3rd edition -Asia Law House Hyderabad, 2010.
2. Forensic science – an introduction to Scientific crime investigation – H.J.Walls – 2nd edition- Universal Law publishing Co. Delhi, 2006.
3. Dhruba Charan Dash, Analytical Chemistry, PHI Learning Private Ltd., 2011.