

MANNAR THIRUMALAI NAICKER COLLEGE
PASUMALAI, MADURAI- 625 004

(An Autonomous Institution Affiliated to Madurai Kamaraj University)

(Re-accredited with 'A' Grade by NAAC)



B.Sc., Chemistry

SYLLABUS AND REGULATIONS

UNDER
CHOICE BASED CREDIT SYSTEM (CBCS)
(For those who joined during 2018-2019 and after)

Qualification for Admission

Candidate should have passed the Higher Secondary Examination conducted by the Board of Higher Secondary Education, Government of Tamil Nadu, CBSE Board with Chemistry as one of the subjects in Higher Secondary Education.

Duration of the Course

The students shall undergo the prescribed B.Sc(Chemistry) course of study for a period of three academic years (six semesters).

Subject of Study

- Part I: Tamil
- Part II: English
- Part III:
 - 1. Core Subjects
 - 2. Allied Subjects
 - 3. Electives
- Part IV :
 - 1. Non Major Electives
 - 2. Skill Based Subjects
 - 3. Environmental Studies
 - 4. Value Education
- Part V :
 - Extension activities

The scheme of Examination

The components for continuous internal assessment are:

Two tests and their average	--15 marks
Seminar /Group discussion	--5 marks
Assignment	--5 marks
Total	--25 marks

Pattern of the questions paper for the continuous Internal Assessment

(For Part I, Part II, Part III , NME & Skilled Paper in Part IV)

The components for continuous internal assessment are:

Part –A

Six multiple choice questions (answer all) 6 x 01= 06 Marks

Part –B

Two questions (‘either or ‘type) 2 x 07=14 Marks

Part –C

One question out of two 1 x 10 =10 Marks

Total -----
30 Marks

Pattern of the question paper for the Summative Examinations:

Note: Duration- 3 hours

Part –A

Ten multiple choice questions 10 x 01 = 10 Marks

(No Unit shall be omitted; not more than two questions from each unit.)

Part –B

Five Paragraph questions (‘either or ‘type) 5 x 07 = 35 Marks

(One question from each Unit)

Part –C

Three Essay questions out of five 3 x 10 =30 Marks

(One question from each Unit)

Total -----
75 Marks

The Scheme of Examination (Environmental Studies and Value Education)

Two tests and their average --15 marks

Project Report --10 marks*

Total -----
--25 marks

** The students as Individual or Group must visit a local area to document environmental assets – river / forest / grassland / hill / mountain – visit a local polluted site – urban / rural / industrial / agricultural – study of common plants, insects, birds – study of simple ecosystem – pond, river, hill slopes, etc.

Question Paper Pattern

Pattern of the Question Paper for Environmental Studies & Value Education only) (Internal)

Part –A

(Answer is not less than 150 words)

Four questions (‘either or ‘type) 4 x 05=20 Marks

Part –B

(Answer is not less than 400 words)

One question (‘either or ‘type) 1 x 10=10 Marks

	30 Marks
Total	30 Marks

Pattern of the Question Paper for Environmental Studies & Value Education only) (External)

Part –A

(Answer is not less than 150 words)

Five questions (either or type) 5 x 06 =30 Marks

(One question from each Unit)

Part –B

(Answer is not less than 400 words)

Three questions out of Five 3 x 15 = 45 Marks
each unit (One question from each Unit)

	75 Marks
Total	75 Marks

Minimum Marks for a Pass

40% of the aggregate (Internal +Summative Examinations).

No separate pass minimum for the Internal Examinations.

27 marks out of 75 is the pass minimum for the Summative Examinations.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO's)

- PEO1:** Proficiency in Chemistry: To enhance the students to nurture the requirements of industries/laboratories related to chemistry including pharmaceutical/analytical chemistry.
- PEO2:** Professional Growth: To enable the students to demonstrate information literacy skills for acquiring knowledge of chemistry, as a chemist/researcher and also as a life-long learner.
- PEO3:** Analytical Skills: To develop the students to communicate effectively the scientific and research information in both written and oral formats, to both professional scientists and to the public.

PROGRAMME OUTCOMES (PO's) of CHEMISTRY:

- PO1:** The stable basis in chemical principles and higher level of understanding in each of the chemistry sub-disciplines such as organic, inorganic, physical, and analytical as well as fundamental principles of biotechnology, mathematics and physics have been developed.
- PO2:** Developing the working acquaintance of chemical instrumentation and laboratory techniques and be able to use of skills to design and conduct independent work.
- PO3:** An understanding of current ethical issues in chemistry and be able to apply ethical principles in industries / research laboratories.
- PO4:** Acquaintance with the applications of computers in chemistry: Modeling and simulation of chemical phenomena.
- PO5:** Communicate outcomes of work to chemists and non-chemists, including respect for the tradition of careful citation of prior contributions.

PROGRAMME SPECIFIC OUTCOMES

- PSO1:** To ability to employ critical thinking and efficient problem-solving skills in the areas of analytical, inorganic, organic, and physical chemistry.
- PSO2:** To demonstrate proficiency in writing and speaking about chemistry topics in a clear and concise manner to both chemists and non-chemists according to professional standards
- PSO3:** To conceptualize and apply the ideas of chemical sciences in the areas of organic synthesis, synthesis of materials, corrosion inhibition, environment sustainability etc.
- PSO4:** To demonstrate proficiency in the use of appropriate instrumentation to collect and record data from chemical experiments

DEPARTMENT OF CHEMISTRY
(For those who joined in 2018 and after)

COURSE PATTERN

Study Component	I Sem	II Sem	III Sem	IV Sem	V Sem	VI Sem	Total Hours	Total Credit	No. of course	Total marks
Part – I Tamil	6(3)	6(3)	6(3)	6(3)			24	12	4	400
Part –II English	6(3)	6(3)	6(3)	6(3)			24	12	4	400
Part –III										
Core subjects	4(4) 2(0)	4(4) 2(2)	4(4) 2(0)	4(4) 2(2)	5(5) 5(5) 3(0) 3(0) 2(0)	5(5) 5(5) 3(6) 3(5) 2(4)	60	55	13	1300
Core Elective					4(4)	4(4)	8	8	2	200
Allied Physics	4(4) 2(0)	4(3) 2(1)	4(4) 2(0)	4(3) 2(1)			24	16	6	600
Allied Mathematics			4(4)	4(4)	6(4)	6(4)	20	16	4	400
Part-IV										
Skill Based Subjects	2(2) 2(2)	2(2) 2(2)			2(2)	2(2)	12	12	6	600
Environment studies / value education	2(2)	2(2)					4	4	2	200
Non-Major Elective			2(2)	2(2)			4	4	2	200
Part V										
Extension Activities				0(1)			0	1	1	100
Total	30 (20)	30 (22)	30 (20)	30 (23)	30 (20)	30 (35)	180	140	44	4400

SEMESTER – I

Subject Code	Title of the Paper	No. of Courses	Hours/ Week	Credits	Maximum Marks		
					Int	Ext	Tot
18UTAG11	Part-I: Tamil தற்கால கவிதையும் உரைநடையும்	1	6	3	25	75	100
18UENG11	English-II: Exploring Language Through Literature-I	1	6	3	25	75	100
18UCHC11	Part-III Core Subject Inorganic Chemistry -I	1	4	4	25	75	100
18UCHCP1	Major Chemistry Practical – I (Inorganic semi micro Qualitative analysis)	-	2	-	-	-	-
18UPHA11	Part-III Allied Subject Allied Physics – I	1	4	4	25	75	100
18UPHAP1		2	-	-	-	-	
18UCHS11	Part-IV Skill Subject Sugar Technology	1	2	2	25	75	100
18UCHS12	Perfume Chemistry	1	2	2	25	75	100
18UEVG11	Part-IV Mandatory Subject Environmental Studies	1	2	2	25	75	100
	TOTAL	7	30	20	175	525	700

SEMESTER – II

Subject Code	Title of the Paper	No. of Courses	Hours/Week	Credits	Maximum Marks		
					Int	Ext	Total
18UTAG21	Part I:Tamil பக்தி இலக்கியமும் நாடகமும்	1	6	3	25	75	100
18UENG21	Part II : English Exploring Language Through Literature-II	1	6	3	25	75	100
18UCHC21	Part-III Core Subject Organic Chemistry-I	1	4	4	25	75	100
18UCHCP1	Major Chemistry Practical – I (Inorganic semi micro Qualitative analysis)	1	2	2	40	60	100
18UPHA21	Part-III Allied Subject Allied Physics –II	1	4	3	25	75	100
18UPHAP1	(Thermal Physics and Sound) Allied Physics Practical – I	1	2	1	40	60	100
18UCHS21	Part-IV Skill Subject Leather Technology	1	2	2	25	75	100
18UCHS22	Paper and Pulp Technology	1	2	2	25	75	100
18UVLG21	Part –IV Mandatory Subject Value Education	1	2	2	25	75	100
	Total	9	30	22	255	645	900

SEMESTER –III

Subject Code	Title of the Paper	No. of Courses	Hours /Week	Credits	Maximum Marks		
					Int	Ext	Total
18UTAG31	Part –I Tamil காப்பிய இலக்கியமும் சிறுகதையும்	1	6	3	25	75	100
18UENG31	Part –II English Subject Exploring Language Through Literature-III	1	6	3	25	75	100
18UCHC31	Part-III Core Subject Physical Chemistry-I	1	4	4	25	75	100
18UCHCP2	Volumetric Analysis Practical	-	2	-	-	-	-
18UMCA32	Part-III Allied Subject Allied Mathematics-I	1	4	4	25	75	100
18UPHA31	Allied Physics – III (Electricity and Electronics)	1	4	4	25	75	100
18UPHAP2	Allied Physics Practical – II	-	2	0	-	-	-
18UCHN31	Part-IV Non Major Elective Waste Water Treatment	1	2	2	25	75	100
	Total	6	30	20	150	450	600

SEMESTER IV

Subject Code	Title of the Paper	No. of Courses	Hours /Week	Credits	Maximum Marks		
					Int	Ext	Total
18UTAG41	Part –I Tamil பழந்தமிழ் இலக்கியமும் புதினமும்	1	6	3	25	75	100
18UENG41	Part –II English Subject Exploring Language Through Literature-IV	1	6	3	25	75	100
18UCHC41	Part-III Core Subject Inorganic Chemistry - II	1	4	4	25	75	100
18UCHCP2	Volumetric Analysis Practical	1	2	2	40	60	100
18UMCA42	Part-III Allied Subject Allied Mathematics – II	1	4	4	25	75	100
18UPHA41	Allied Physics - IV (Optics and Modern Physics)	1	4	3	25	75	100
18UPHAP2	Allied Physics Practical -II	1	2	1	40	60	100
18UCHN41	Part IV -Non Major Elective Polymer Chemistry	1	2	2	25	75	100
18UEAG40 - 18UEAG49	Part V- Extension Activities	1	0	1	100	-	100
	Total	9	30	23	355	645	900

SEMESTER – V

Subject Code	Title of the Paper	No. of Courses	Hours /Week	Credits	Maximum Marks		
					Int	Ext	Total
18UCHC51	Part-III Core Subject Organic Chemistry-II	1	5	5	25	75	100
18UCHC52	Physical Chemistry-II	1	5	5	25	75	100
18UCHCP3	Physical Chemistry experiments (Practical)		3	0			
18UCHCP4	Gravimetric Analysis and Organic Preparation (Practical)		3	0			
18UCHCP5	Organic Analysis and Estimation (Practical)		2	0			
18UMCA52	Part-III Allied Subject Allied Mathematics – III	1	6	4	25	75	100
18UCHE51	Part- III Core Elective Inorganic and Analytical Chemistry	1	4	4	25	75	100
18UCHE52	Bioinorganic Chemistry						
18UCHE53	Clinical and Medicinal Chemistry						
18UCHS51	Part-IV Skill Subject Drug Chemistry	1	2	2	25	75	100
	Total	5	30	20	125	375	500

SEMESTER – VI

Subject Code	Title of the Paper	No. of Courses	Hours /Week	Credits	Maximum Marks		
					Int	Ext	Total
	Part-III Core Subject						
18UCHC61	Organic Chemistry-III	1	5	5	25	75	100
18UCHC62	Physical Chemistry-III	1	5	5	25	75	100
18UCHCP3	Physical Chemistry experiments (Practical)	1	3	6	40	60	100
18UCHCP4	Gravimetric Analysis and Organic Preparation	1	3	5	40	60	100
18UCHCP5	(Practical) Organic Analysis and Estimation (Practical)	1	2	4	40	60	100
18UMCA62	Part-III Allied Subject Allied Mathematics – IV	1	6	4	25	75	100
	Part- III Core Elective Applied Chemistry						
18UCHE61	Nanochemistry	1	4	4	25	75	100
18UCHE62	Fundamentals of Computer and Green Chemistry						
18UCHE63							
18UCHS61	Part-IV Skill Subject Macromolecular Chemistry	1	2	2	25	75	100
	Total	8	30	35	245	555	800



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)

DEPARTMENT OF CHEMISTRY

(For those who joined in 2018-2019 and after)

Programme : UG

Semester : V

Subject Code : 18UCHC51

Part III : Core

Hours : 05

Credits : 05

ORGANIC CHEMISTRY –II**Course outcomes:****On successful completion of the course, the learners should be able to:****CO1:** Recall the general characteristics of aromatic compounds and discuss the reaction mechanism of aromatic compounds. [K1 & K2]**CO2:** Prepare the aromatic compounds like aromatic hydrocarbons, halogen, amino, substituted acids, isolated and condensed systems. [K3]**CO3:** Examine the effect of substituents on acidic/basic character of aromatic compounds. [K4]**CO4:** Interpret the directive influence of substituent on electronic effects and properties of aromatic compounds. [K5]**CO5:** Integrate the reaction mechanism of aromatic compounds and formulate in the synthetic applications. [K6]**Unit-1: Aromatic Compounds - I**

Introduction – General characteristics of aromatic compounds –Aromaticity and Huckel’s rule – Structure of benzene – Mechanism of aromatic electrophilic substitution (Halogenation, nitration, sulphonation and Friedel – Crafts reactions. Directive influence of substituents based on electronic effects (ortho/para/meta directing) –Di-substituted benzenes – Steric hindrance – Mechanism of aromatic nucleophilic substitution, unimolecular, bimolecular and benzyne mechanisms

Unit-2: Aromatic Compounds - II

Aromatic aldehydes: Mechanism of Cannizzaro, Perkins, Claisen, Knoevenagel reaction and Benzoin condensation – Preparation and properties of cinnamaldehyde and vanillin. **Phenolic ketones:** Phloroacetophenone – preparation – Houben – Hosch synthesis. **Phenols:** Acidity of phenols – effect of substituents on the acidity of phenol – mechanism of Kolbe’s reaction.

Unit-3: Aromatic Hydrocarbons, Halogen, Nitro and Amino Compounds

Aromatic Hydrocarbons: Preparation, properties and uses of toluene xylene and mesitylene –**Aromatic halogen compounds:** preparation, Properties and uses of bromobenzene and benzyl bromide- Reactivity of aryl halides, distinction between nuclear and side chain halogenated derivatives. **Aromatic nitro compounds:** preparation and properties of nitrotoluenes. **Aromatic amino compounds:** Preparation by reduction of nitro compounds and from chlorobenzene – Effect of substituents on the basic character of aromatic amines – Comparison between aliphatic and aromatic amines – Preparation of aniline, sulphanilic acid,

nitroanilines and phenylenediamines – Preparation and synthetic applications of benzene diazonium chloride

Unit-4: Aromatic Acids

Effect of substituent's on acidic character. **Substituted acids:** preparation, properties of salicylic acid and anthranilic acid. **Mono & Dicarboxylic acids:** preparation, properties of phthalic acid, phenylacetic acid, mandelic acid, cinnamic acid & coumarin. **Aromatic Sulphonic acids:** preparation, properties and uses of benzene sulphonic acid, saccharin, chloramine -T and dichloramine – T.

Unit -5: Poly Nuclear Hydrocarbons and Their Derivatives

Isolated systems: Preparation and properties of diphenyl, benzidine diphenic acid, diphenylmethane, triphenylmethane and stilbene. **Condensed systems:** Preparation properties, uses and structure of Naphthalene, Naphthylamines, Naphthols, Naphthaquinones, anthracene, anthraquinone, alizarin and phenanthrene.

Text Books

1. Soni. P.L and Chawla. H.M, Textbook of Organic Chemistry, S. Chand & Sons, 2007, New Delhi.

Reference Books

1. Jain. M.K, and Sharma. S.C, Modern Organic Chemistry, 4th Edition, Vishal Publishing Co., 2016, Jalandhar.
2. Arun Bahl and Bahl. B.S, A Textbook of Organic Chemistry, S. Chand & Co., 2012, New Delhi.
3. Jerry March, Advanced Organic Chemistry, 4th Edition, John Wiley and Sons, 1992, New York.
4. S.H. Pine, Organic Chemistry, 5th Edition, McGraw Hill International Edition, Chemistry Series, 1987, New York.
5. Morrison. R.T and Boyd. R.N, Organic Chemistry, 6th Edition, Printice-Hall of India Ltd., 1992, New Delhi.



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF CHEMISTRY
(For those who joined in 2018-2019 and after)

Programme : B.Sc (Chemistry)
Semester : V
Subject Code : 18UCHC52

Part III : Core
Hours : 05
Credits : 05

PHYSICAL CHEMISTRY – II

Course outcomes:

On successful completion of course, Students will be able to:

- CO1:** Outline the basic principles and applications of chemistry in detail. [K1&K2]
CO2: Apply the concept of duality, spectroscopic techniques, symmetry aspects, theory of dilute solutions and phase equilibrium for chemical systems. [K3]
CO3: Analyze the concept of quantum theory, the physical properties of various equilibria and spectroscopic parameters. [K4]
CO4: Evaluate the practical utility of complicated problem-solving skill aspects. [K5]
CO5: Develop a strategy to acquire advanced knowledge in various analytical techniques. [K6]

Unit – 1: Quantum Mechanics

Particle and wave nature of electron de Broglie's theory – Equation – Davison – Germer experiment – photoelectric effect – Compton effect – Heisenberg's uncertainty principle – The Schrodinger wave equation (Derivation not required). Postulates of quantum theory – Eigen values and eigen function – signification of ψ and ψ^2 - quantum number – Zeeman effect.

Unit – II: Colligative Properties and Dilution Solution

Colligative properties – Relative lowering of vapor pressure, Depression of freezing point, Elevation of boiling point and osmotic pressure – Determination of molecular weight and K_f by Rast macro method. Phase Rule - definitions – Gibb's phase rule – one component system – water carbon dioxide and sulphur – polymorphism – two components system – reduced phase rule – simple eutectic system – Pb-Ag System – KI-water system – Partially miscible liquid system – CST – completely immiscible liquid system. **Distribution Law:** Mathematical formulation – experimental verification – condition under which the law is obeyed.

Unit – III: Group Theory

Molecular symmetry elements and symmetry operations – operations – production of symmetry operations – properties of a group – classes and sub groups – groups multiplication table – C_{2v} . Point groups – classification of molecules into point groups – C_{2v} , C_{3v} , C_{2h} , D_{2h} , D_{3h} , D_{4h} , D_{6h} , T_d and O_h .

UNIT – IV: Spectroscopy – I

Introduction – electromagnetic radiation – different regions – absorption spectroscopy – molecular spectra – types of molecular spectra. Rotational spectra of diatomic molecules – Rigid rotator – selection rule-determination of moment of inertia and bond length – intensities of spectral line – effect of isotropic substitution – calculation of bond length. Vibrational spectra – IR spectra of diatomic molecules – Hooke's law – simple harmonic oscillator - force constant – selection rule – Vibrational energy level diagram – Anharmonic oscillator –force constant determination. Modes of vibration in polyatomic molecules – linear (CO₂) and nonlinear (H₂O)

UNIT – V: Spectroscopy – II

Raman spectra – Raman effect – stokes and anti stokes lines – quantum theory of Raman effect – experimental study – comparison between IR and Raman spectra – applications of Raman spectra. Electronic spectra – Franck and Condon principle – Nuclear magnetic resonance spectroscopy – principle, instrumentation – interpretation of NMR spectra – spectra of ethanol – Electron spin resonance spectroscopy – principle – difference between NMR and ESR- Hyperfine structure in ESR spectrum – selection rule – Hydrogen atom ESR spectrum.

Text Books

1. Puri. B.S, Sharma. L.R and Pathania.S, Principles of Physical Chemistry, 47th Edition, Shoban Lal Nagin Chand & Co., 2012, New Delhi.

Reference Books

1. Gilbert W. Castellan, Physical Chemistry, 4th Edition, Narosa Publishing House, 2004, New Delhi.
2. Atkins. P.W, Physical Chemistry, 7th Edition, Oxford University, Press, 2001.
3. Dogra. S.K and Dogra. S, Physical Chemistry through Problems, 4th Edition, New Age International, 1996.



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF CHEMISTRY
(For those who joined in 2018-2019 and after)

Programme : UG	Part III : Core
Semester : V&VI	Hours : 03
Subject Code : 18UCHCP3	Credits : -

PHYSICAL CHEMISTRY EXPERIMENTS (PRACTICAL)

Course outcomes:

On successful completion of the course, the learners should be able to:

- CO1:** Recall the molecular weight of chemical compounds and discuss the determination of molecular weight by various methods. [K1 & K2]
CO2: Determine the CST of phenol-water system, cell constant and conductivity titrations. [K3]
CO3: Inspect the phase diagram involving simple eutectic and compound formation. [K4]
CO4: Interpret the relative strength of acids by hydrolysis of ester [K5]
CO5: Predict the effect of impurity on CST of phenol-water system. [K6]

I. Determination of Molecular weight by

- a) Transition Temperature method – Sodium thiosulphate pentahydrate
- b) Rast Macro method – Naphthalene as Solvent

II. Phase diagram involving

- a) Simple eutectic
- b) Compound formation

III. Critical solution temperature (CST)

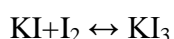
- Determination of CST of phenol – water system and effect of impurity on CST –
- Determination of Strength of NaCl.

IV. Potentiometric titrations

- (a) HCl Vs NaOH
- (b) $K_2Cr_2O_7$ Vs $FeSO_4$.

V. Partition Coefficient experiments:

Study of the equilibrium constant for the reaction



By determining the partition Co-efficient of I_2 between water and CCl_4

Determination of strength of given KI.

- VI. Kinetics:** Determination of relative strength of acids by hydrolysis of ester.
- VII. Conductivity:** Determination of cell constant and conductivity titration between an acid and a base (HCl Vs NaOH).

Text Book

1. Thomas. A.O and Mani, Textbook of Practical Chemistry, 4th Revised Edition, Scientific Publication, 1976.

Distribution of Marks (Max. marks – 100)

Duration of examination: 6 hrs

Regular Test in the Class	: 30 Marks
Observation note book	: 10 Marks

Total	: 40 Marks

Viva voce	: 10 marks
Record Note book	: 10 marks
For completion of the experiment	: 20 marks
Graph	: 2 marks
Calculation	: 5 marks
Tabulation	: 3 marks
Result	: 10 marks

Total	: 60 marks



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)

DEPARTMENT OF CHEMISTRY

(For those who joined in 2018-2019 and after)

Programme : UG

Semester : V&VI

Subject Code : 18UCHCP4

Part III : Core

Hours : 03

Credits : -

GRAVIMETRIC ANALYSIS AND ORGANIC PREPARATION (PRACTICAL)

Course outcomes:

On successful completion of the course, the learners should be able to:

CO1: Relate and classify between gravimetric analysis and organic preparation [K1 & K2]

CO2: Estimate lead, barium, calcium, copper and nickel. [K3]

CO3: Analyze the various types of organic preparation. [K4]

CO4: Interpret the organic preparation like nitration, bromination, hydrolysis, oxidation, benzylation and acetylation. [K5]

CO5: Assemble the analyzed and prepared organic compounds samples. [K6]

1. Gravimetric Analysis

1. Estimation of lead as lead chromate
2. Estimation of barium as barium chromate
3. Estimation of calcium as calcium oxalate monohydrate
4. Estimation of copper as cuprous thiocyanate
5. Estimation of nickel as Ni DMG.

2. Organic Preparation

1. Nitration
 - a. M-dinitrobenzene from nitrobenzene
 - b. Picric acid from phenol
2. Bromination: p-bromo acetanilide from acetanilide
3. Hydrolysis : Aromatic acid from (a) an ester (b) an amide
4. Oxidation: Benzoic acid from benzaldehyde.
5. Benzoylation: (a) Amine (b) phenols.
6. Acetylation : (a) Amine (b) phenols

Text Books

1. Thomas. A.O and Mani, Textbook of Practical Chemistry, 4th Revised Edition, Scientific Publication, 1976.
2. N.S. Gnana pragasam and G. Ramamurthy, Organic Chemistry Lab Manual, Viswanath. S. Printers & Publishers Pvt. Ltd., 2010, Chennai.

Distribution of Marks (Max.marks – 100)

Duration of examination: 6 hrs

Int: 40

Regular Test in the Class : 30 Marks

Observation note book : 10 Marks

Total : 40 Marks

Record Note Book - 10 Marks

Viva Voce - 10 Marks

Ext: 60

Organic preparation (10 Marks)

Gravimetric Estimation (30 Marks)

Procedure - 2 Marks

Crude sample - 6 Marks

Recrystallised sample - 2 Marks

Procedure - 10 Marks

Estimation - 20 Marks

Less than 2 % Error – 20 Marks

2-3% Error – 18 Marks

3-4% Error – 16 Marks

4-5% Error – 14 Marks

Greater than 5% Error – 8 Marks



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)

DEPARTMENT OF CHEMISTRY

(For those who joined in 2018-2019 and after)

Programme	: UG	Part III	: Core
Semester	: V&VI	Hours	: 02
Subject Code	: 18UCHCP5	Credits	: -

ORGANIC ANALYSIS AND ESTIMATION (PRACTICAL)

Course outcomes:

On successful completion of the course, the learners should be able to:

- CO1:** State functional group and classify the organic compounds containing one or two functional groups. [K1 & K2]
- CO2:** Estimate the organic compound like phenol, aniline and glucose. [K3]
- CO3:** Distinguish between organic analysis and organic estimation. [K4]
- CO4:** Justify the conformation by the preparation of a solid derivative. [K5]
- CO5:** Assemble the analyzed and estimated given organic compounds. [K6]

I. Organic Analysis

Analysis of an organic compound containing one or two functional groups and confirmation by the preparation of a solid derivative – acids, phenols, aldehydes, ketone, esters, nitro compounds, amines (primary, secondary and tertiary), aniline, aliphatic diamide, side chain and nuclear halogen compounds, diamide containing sulphur and monosaccharide.

II. ORGANIC ESTIMATION

1. Estimation of phenol
2. Estimation of aniline
3. Estimation of glucose

Text Books

1. Thomas. A.O and Mani, Textbook of Practical Chemistry, 4th Revised Edition, Scientific Publication, 1976.
2. Gnanapragasam. N.S and Ramamurthy. G, Organic Chemistry Lab Manual, Viswanath.S Printers & Publishers Pvt. Ltd., 2010, Chennai.

Distribution of Marks (Max. marks – 100)

Duration of examination: 6 hrs

Regular Test in the Class	: 30 Marks
Observation note book	: 10 Marks

Total	: 40 Marks

Organic estimation (30 Marks)

Record Note	- 10 marks
Procedure	- 5 marks
Estimation	- 15 marks
Less than 3% Error	- 15 Marks
3-4% Error	- 13 Marks
4-5% Error	- 10 Marks
Greater than 5%	- 8 Marks

Organic analysis (30 Marks)

Viva Voce	- 10 marks
Preliminary reaction	- 2 marks
Elements present	- 4 marks
Aliphatic or aromatic	- 3 marks
Saturated / Unsaturated	- 3 marks
Functional group	- 6 marks
Derivative	- 2 marks



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF CHEMISTRY
(For those who joined in 2018-2019 and after)

Class : B.Sc., Chemistry **Part III : Allied**
Semester : V **Hours : 06**
Subject Code : 18UMCA52 **Credits : 04**

ALLIED MATHEMATICS – III

Course Outcomes:

CO1: To develop the skills in Mathematical formulation and Solving of LPP.

CO2: To learn about different techniques on solving LPP

CO3: To solve specialized LPP like transportation and assignment problems.

CO4: To introduce about Network problems.

Unit-I:

Mathematical Formulation of a LPP: General form of a LPP – Summation notation – Matrix form – Canonical form – Standard form - Solution of LPP by Graphical Method.

Unit-II:

The Simplex Method – The Big M Method – Duality in LPP (Problems only).

Unit- III:

Transportation Problems: Mathematical Formulation of TP - Determining Initial Basic Feasible Solution (all methods) - Optimum solution of TP (MODI Method).

Unit -IV:

Assignment Problems: Mathematical formulation of Assignment Problems – Solution to Assignment Problems.

Unit -V:

Network Flow Problems – Minimal Spanning Tree Problem – Shortest Route Problems.

Text Books:

1. Dr. S. Arumugam & A.Thangapandi Isaac, **Topics in Operations Research – Linear Programming**, New Gamma Publishers Pvt. Ltd, Palayamkottai, Tirunelveli, March 2015.
2. Kanti Swarup, P.K. Gupta, Man Mohan, **Operations Research**, 17th Edition, Sultan Chand and Sons, New Delhi, 2014.

Unit I: Text Book 1: Chapter 3 - Sections: 3.2, 3.4.

Unit II: Text Book 1: Chapter 3 – Sections: 3.5, 3.6, 3.9.

Unit III: Text Book 1: Chapter 4 – Section: 4.1

Unit IV: Text Book 1: Chapter 5 – Sections: 5.1, 5.2

Unit V: Text Book 2: Chapter 24 – Sections: 24.2, 24.3, 24.4.

Reference Books:

1. Rathindra P. Sen, **Operations Research Algorithms and Applications**, PHI, EEE, New Delhi, 2010.
2. R. Panneer Selvam, **Operations Research**, PHI, New Delhi, Second Edition, 2010.
3. S.Kalavathy, **Operations Research**, Vikas publishing house Pvt Ltd., New Delhi, 4th Edition, 2013.



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)

DEPARTMENT OF CHEMISTRY

(For those who joined in 2018-2019 and after)

Programme : UG

Semester : V

Subject Code : 18UCHE51

Part III : Elective

Hours : 04

Credits : 04

INORGANIC AND ANALYTICAL CHEMISTRY

Course outcomes:

On successful completion of the course, the learners should be able to:

CO1: Recall the general characteristics of acids & bases and solid state and discuss the various concepts and methods involved in it. [K1 & K2]

CO2: Determine the classification of solvents and role of alkali and alkaline earth metal in biological systems. [K3]

CO3: Examine the bio inorganic compounds on its structure and analytical methods of obtaining precipitate. [K4]

CO4: Interpret the biological functions and toxicity of elements and basic principles of common types of chromatography. [K5]

CO5: Integrate the types of crystals and point defects. [K6]

UNIT – I: Acids & Bases

Acids and bases – Arrhenius concept – Lowry Bronsted concept:- Conjugate acid – base pairs, relative strengths of acids and bases – Lux & Flood concept – limitations – Lewis concept – Levelling effect – Usanovich concept – hard and soft acids. Non aqueous solvents: Classification of solvents – Chemical reaction in liquid ammonia – Precipitation reaction – Acid – base reactions in liquid ammonia – Protolysis – Ammonolysis.

UNIT – II: Bio Inorganic Chemistry

Metalloporphyrins – Porphyrins – Chlorophyll – Vitamin B₁₂. Myoglobin and hemoglobin – Structure – their role in biological systems – Hill constant, cooperativity effect, Bohr effect, Explanation for cooperativity effect in hemoglobin. Role of alkali and alkaline earth metal ions in biological systems – Role of Na⁺ and K⁺ ions – sodium pump – Role of Mg²⁺ and Ca²⁺ ions. Biological functions and toxicity of elements – Cr, Cu, As and radioactive elements.

UNIT – III: Analytical Chemistry

Methods of obtaining the Precipitate – Condition – Choice of Precipitant – merits and demerits of Organic Precipitants – Types – Specific and selective precipitants Sequestering agents – theory of precipitation – Dendrites – Paneth – Fajans – Hahn – law – Co precipitation – post precipitation – precipitation from homogeneous solution. Precision – Accuracy – Absolute and relative error – Classification of errors – Confidence Limit –

Students Q-test –Rejection of experimental data – Sources and elimination of errors – Significant figures and computation.

UNIT – IV: Analysis of experimental results

Graphical method – Curve fitting – Method of least squares – Problems involving straight line graphs - Instrumental methods of Analysis - Beer – Lamberts Law – Principles of Colorimetric Analysis – Visual Colorimeter – Standard Series method – Balancing method – Estimation of Ni^{2+} , Fe^{2+} - Basic principles of common types of Chromatography – Column Chromatography – Thin layer Chromatography – Paper Chromatography – Ion exchange Chromatography -Applications of each technique.

UNIT – V: Solid State

X-ray diffraction – Bragg's equation – Experimental method of determination of interplanar spacing – X-ray spectrophotometer – Debye Scherrer method. Types of Crystals – Ionic crystals – Analysis of NaCl, KCl, CsCl – determination of Avagadro number – Molecular crystals – Water and Ammonia – Covalent crystals – Diamond and Graphite – Metallic crystals – Metallic bond in metals, Conductors, Insulators and Semiconductors – Frankel and Schottky defects.

Text Books:

1. Puri. B.R, Sharma. L.R and Kalia. K.C, Principles of Inorganic Chemistry, ShobanLal Nagin Chand & Co., 1996, New Delhi.
2. Guldeep R. Chatwal and Shank K. Anand, Instrumental Methods of Chemical Analysis, Himalaya Publishing House, 2008, Mumbai.
3. SathyaPrakash, G.D. Tulil, S.K. Basu and R.D. Madan, A Textbook of Advanced Inorganic Chemistry, S. Chand & Co., 2014, New Delhi.

Reference Books:

1. Sharma. Y.R, Elementary Organic Spectroscopy, S. Chand & Co., 1990, New Delhi.
2. Huheey, J.E, Keiter. E.A and Keiter.R.L, Inorganic Chemistry, 4th Edition, Harper Collins, 1993, New York.
3. Cotton. F.A, Wilkinson. G, Murillo. C and Bochman. M, Advanced Inorganic Chemistry, 6th Edition, John Wiley, 1999, New York.
4. Gopalan. R, Analytical Chemistry, S. Chand & Co., 2004, New Delhi.



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF CHEMISTRY
(For those who joined in 2018-2019 and after)

Programme : UG

Semester : V

Subject Code: 18UCHE52

Part III : Core Elective

Hours : 04

Credits : 04

BIOINORGANIC CHEMISTRY

Course outcomes:

On successful completion of the course, the learners should be able to:

CO1: Identify the fundamentals of biomolecules and metals in biological systems and generalize their structures. [K1 & K2]

CO2: Estimate the structures of myoglobin & hemoglobin, copper & nitrogen enzymes. [K3]

CO3: Comment the behavior of dioxygen bound to metals and role of metals in medicine. [K4]

CO4: Interpret the structure of the active site in myoglobin & hemoglobin. [K5]

CO5: Integrate the metals containing proteins and enzymes and metal toxicity. [K6]

UNIT – I: Metals in Biology

Introduction – Essential Chemical Elements – Metals in Biological Systems – Biological Metal Ion Complexation – Electronic and Geometric Structures of Metals –Metals in Biological Systems – Metals containing proteins and enzymes.

UNIT – II: Fundamentals of Biomolecules

Proteins – Amino Acid Building Blocks – Protein Structure – Protein Sequencing and Proteomics – Protein Function, Enzymes, Classification of enzymes – Enzyme Kinetics – Enzyme Inhibition

UNIT – III: Myoglobin and Hemoglobin

Myoglobin and Hemoglobin: Structure of the Prosthetic Group – Mechanism for Reversible Binding of Dioxygen and Cooperativity of Oxygen Binding – Behavior of Dioxygen Bound to Metals – Structure of the Active Site in Myoglobin and Hemoglobin – Binding of CO to Myoglobin, Hemoglobin.

UNIT – IV: Copper and Nitrogen Enzymes

Copper Enzymes: Occurrence – Structure – Function – Discussion of Specific Enzymes: Superoxide Dismutase – Hemocyanin.

Enzyme Nitrogenase: Iron–Sulfur Clusters – Fe–Protein Structure – Detailed Mechanistic Studies.

UNIT – V: Role of Metals in Medicine

Inorganic Medicinal Chemistry - Metal Toxicity and Homeostasis – Anti-cancer agents: Cisplatin and related compounds - Chelation therapy – Cancer treatment – Anti-arthritis drugs – Gadolinium MRI Imaging Agents.

Text Books:

1. Hussain Reddy. K, Bioinorganic Chemistry, New Age International, 2003, New Delhi.
2. Malik. W.U, Tuli. G.D, Madan. R.D, Selected topics in Inorganic Chemistry, 7th Edition, S. Chand & Co., 2003, New Delhi.

Reference Books:

1. Rosette M. Roat Malone, Bioinorganic Chemistry: A short course, Wiley – Interscience, John Wiley & Sons, Inc., 2002.
2. Miessler. G.L and Donald A. Tarr, Inorganic Chemistry, Pearson Publication, 2002.
3. James E. Huheey, Ellen Keiter and Richard Keiter, Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Publication, 1993.
4. Lippard. S.T and Berg. T.M, Principles of Bioinorganic Chemistry, Panima Publishing Co., 1997, New York.



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)

DEPARTMENT OF CHEMISTRY

(For those who joined in 2018-2019 and after)

Programme : UG

Semester : V

Subject Code : 18UCHE53

Part III : Core Elective

Hours : 04

Credits : 04

CLINICAL AND MEDICINAL CHEMISTRY

Course outcomes:

On successful completion of the course, the learners should be able to:

CO1: Define health, drugs, enzymes and outline the clinical hygiene, manufacture of drugs and classification of enzymes. [K1 & K2]

CO2: Estimate the testing of drugs, coenzymes and biotechnology. [K3]

CO3: Examine the types of drugs and their modes of action and body fluid. [K4]

CO4: Interpret the disease affecting red cells and recombinant DNA, Genetic engineering and its possible hazards. [K5]

CO5: Formulate the treatment for specific poisons and drug manufacture based on fermentation. [K6]

UNIT – I: Clinical Hygiene and Biochemical Analysis

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

UNIT – II: Common Drugs

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

i. Acting at neuromuscular junction (d – tubocurarine chloride).

ii. Acting at spinal cord alone (glyceryl guaiacolate, diazepam). Antibiotics (penicillin, streptomycin, tetracyclin, chloramphenicol)

Cardiovascular drugs-nitrates, beta blockers (propranolol and atenolol) and calcium channel blockers.

UNIT – III: Enzymes

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

UNIT – IV: Body Fluid

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

UNIT – V: Biotechnology

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

Text Books:

1. Jayashree Ghosh, A Textbook of Pharmaceutical Chemistry, S. Chand & Co., New Delhi, 1999.
2. Rastogi. S.C, Biochemistry, Tata McGraw Hill Publishing Co., 1993.
3. Ashutosh Kar, Medicinal Chemistry, Wiley Eastern Ltd., 1993, New Delhi.

Reference Books:

1. Le Roy, O, Natural and Synthetic Organic Medicinal Compounds, Ealemi, 1976.
2. Oser, B.L, Hawk's Physiological Chemistry, 14th Edition, Tata McGraw Hill Publishing Co., 1965.
3. Kleiner. O and Martin. J, Biochemistry, Prentice-Hall of India, 1974, New Delhi.



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)

DEPARTMENT OF CHEMISTRY

(For those who joined in 2018-2019 and after)

Programme : UG	Part IV : Skill
Semester : V	Hours : 02
Subject Code : 18UCHS51	Credits : 02

DRUG CHEMISTRY

Course outcomes:

On successful completion of the course, the learners should be able to:

CO1: Mention and outline the action of drugs. [K1 & K2]

CO2: Identify role of drug as therapeutic. [K3]

CO3: Justify and write various chemical processes taking place in all derivatives of drug. [K4]

CO4: Identify various types of reactions and can illustrate its scope to wider areas. [K5]

CO5: Describe feasibility and the extent of application of drug. [K6]

UNIT – I: Introduction to the different systems of medicine

Different systems of medicine: Ayurveda, Siddha, Homeopathy and Allopathy – History of medicinal chemistry – discovery of drugs – Introduction. Analgesics and Antipyretics – Narcotic analgesics – Morphine and derivatives. Total synthetic analgesics pethidine and methadone. Antipyretic analgesics – salicylic acid derivatives, Indole derivatives and p-amino phenol derivatives (Medicinal uses and structure only). Antibiotics – Definition, Penicillin – Tetracycline (Auramycin & Terramycin) – Streptomycin and Chloromycetin – drug action and uses.

UNIT – II: Anaesthetics

Gaseous anaesthetics – Vinyl ether – Cyclopropane – Halo hydrocarbons – Chloroform – Haloethane– Trichloro ethylene – Intravenous anaesthetics – Thiopentone – Local anaesthetics – Cocaine and its derivatives. (Therapeutic use only)

UNIT – III: Chemotherapy and Application of a Few Drugs (Elementary study)

Sulpha drugs – Sulphadiazine, prontosil and prontosil-S. Antimalarials – quinine and its derivatives. Arsenical drugs – Salvarsan – 606 – Neosalvarsan.

UNIT – IV: Synthetic Drugs

Synthetic drugs and its therapeutic function of paracetamol – Aspirin – naproxen – Amoxyllin – ciprofloxacin – Ibuprofen.

Visit to an Industry and submission of Report. For industrial visit / Assignment = 5 marks internal) Contact District Industrial Centre (DIC for visits)

UNIT – V: Hormones and Vitamins

Definition and Classification Testosterone, Progesterone, Thyroxine, Vitamin C, Structure only
(Structural elucidation not necessary)

Text Book:

1. Jayashree Ghosh, A Textbook of Pharmaceutical Chemistry, S. Chand & Co., 1999, New Delhi.

Reference Books:

1. Charles R. Craig and Robert E. Stitzel, Modern Pharmacology, 3rd Edition, Little Brown and Co., Boston, 1990.
2. Corwin Hansch, Peter G. Sammer, John B. Taylor and Peter D.K. Kennewell, Comprehensive Medicinal Chemistry, Pergmon Press, Great Britain, 1990.
3. Bertram G. Katzung, Basic and Clinical Pharmacology, Lange Medical Publications, Atos, 1982, California.



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF CHEMISTRY
(For those who joined in 2018-2019 and after)

Programme : UG **Part III : Core**
Semester : VI **Hours : 05**
Subject Code : 18UCHC61 **Credits : 05**
ORGANIC CHEMISTRY – III

Course outcomes:

On successful completion of the course the learners should be able to:

CO1: Reminisce the alicyclic compounds, free radicals and proteins and deliberate the reaction mechanism of aromatic compounds. [K1 & K2]

CO2: Prepare the heterocyclic compounds, short lived and long-lived free radicals. [K3]

CO3: Differentiate between configuration and conformation and between proteins and nucleic acids. [K4]

CO4: Interpret the directive influence of substituents on electronic effects and properties of aromatic compounds. [K5]

CO5: Integrate the reaction mechanism of aromatic compounds and formulate in the synthetic applications. [K6]

UNIT – I: Alicyclic compounds, Conformational analysis, Civetone and Muscone

Alicyclic compounds: General methods of preparation and properties of cyclo paraffines – Baeyer’s strain theory and its modification. **Conformational Analysis:** Difference between configuration and conformation- Fisher- Saw horse and Newman Projection formulate – Conformational analysis of ethane, n-butane 1,2– dichloroethane, cyclohexane and monosubstituted cyclohexane. Civetone and Muscone any one method of synthesis – Structure only (no Structural elucidation)

UNIT – II: Molecular rearrangement and Free radicals

Molecular rearrangements: Detailed mechanisms of the following: pinacol - Pinacolone, Hofmann, Curtius, benzil-benzilic acid, claisen, benzidine, Beckmann, Fries and Wagner-Meerwein rearrangements. **Free radicals:** Definition – preparation and reactions of short lived and long-lived free radicals – stability of free radicals – detection of free radicals – chain reactions – photochemical reactions of olefins. cis-trans isomerization. Mechanism of Sand Meyer reaction, Gomberg reaction and Hofmann-Loeffler reaction.

UNIT – III: Heterocyclic compounds

Heterocyclic compounds: Introduction and definition, Preparation and basic properties of pyrrole, pyridine, quinoline and isoquinoline. **Alkaloids:** Definition – occurrence and extraction of alkaloids – general methods for determining the structure of alkaloids – classification of alkaloids – structural elucidation – coniine, piperine and nicotine. **Terpenes:** Introduction, classification, occurrence and isolation – general properties – isoprene rule – general methods of determining structure. Properties, Structure of citral and terpineol.

UNIT – IV: Proteins and Nucleic acids

Proteins: Definition – Classification of proteins – colour reactions of proteins – primary, secondary, tertiary and quaternary structure of proteins (an elementary idea only). **Nucleic acids:** Definition – Classification of Nucleic acids – nucleosides – nucleotides – RNA and DNA general structure.

UNIT – V: Principles and Applications of Spectroscopy

UV: Introduction– Type of electronic transition – absorption law bathochromic shift and hypso chromic shift – hyperchromic and hypochromic effect – applications of UV to organic compounds – Woodward - Fieser calculation of λ_{\max} . **IR:** Introduction – Instrumentation– different regions of IR, finger print regions – fundamental, overtone, Hot bands and combination bands – applications of IR to organic compounds – effect of hydrogen bonding – NH_2 . **NMR:** Introduction – chemical shift – shielding and deshielding effects - factors influencing chemical shift – solvent used (TMS) – splitting of signals – NMR spectra of simple ethanol and anisole. Conditions for NMR active.

Text Book:

1. Soni, P.L and Chawla. H.M, A Textbook of Organic Chemistry, S. Chand & Co., 2007, New Delhi.

Reference Books:

1. Jain. M.K and Sharma. S.C, Modern Organic Chemistry, 4th Edition, Vishal Publishing CO., 2016, Jalandhar.
2. Bahl. B.S and ArunBahl, A Textbook of Organic Chemistry, S. Chand & Co., 2012, New Delhi.
3. Jerry March, Advanced Organic Chemistry, 4th Edition, John Wiley & Sons, 1992, New York.
4. Pine, S.H, Organic Chemistry, 5th Edition, McGraw Hill International Edition, Chemistry Series, 1987, New York.
5. Sehan N. Ege, Organic Chemistry – Structure and Reactivity, 3rd Edition, A.I.T.B.S., 1998, New Delhi.
6. Morrison. R.T and Boyd. R.N, Organic Chemistry, 6th Edition, Printice-Hall of India Ltd., 1992, New Delhi.



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)

DEPARTMENT OF CHEMISTRY

(For those who joined in 2018-2019 and after)

Programme : UG

Semester : VI

Subject Code : 18UCHC62

Part III : Core

Hours : 05

Credits : 05

PHYSICAL CHEMISTRY – III

Course outcomes:

On successful completion of the course, the learners should be able to:

CO1: Define thermodynamic terms and photochemical reaction and describe the study of thermal and photochemical reaction. [K1 & K2]

CO2: Relate the thermodynamic process and conductance. [K3]

CO3: Differentiate between reversible and irreversible cells and between photochemical reactions. [K4]

CO4: Evaluate the types of electrodes and determine the emf of cells. [K5]

CO5: Compile Nernst heat Theorem and state the third law of thermodynamics and its applications. [K6]

Unit – I: Thermodynamics – I

Definition of thermodynamic terms: system, surroundings – types of systems, intensive and extensive properties – State and path functions and their differentials – Thermodynamic process – Concept of heat and work – Definition of internal energy and enthalpy. Heat capacity – Heat capacities at constant volume and pressure and their relationship – Joule-Thomson effect – Joule-Thomson coefficient and inversion temperature – Calculation of w , q , dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process – Hess's Law of constant heat summation and its applications

UNIT – II: Thermodynamics - II

Need for the second law-different statements of the second law-Carnot cycle and efficiency-Carnot's theorem – Thermodynamic scale of temperature – Entropy as state function – entropy as a function of pressure and volume – Entropy changes of an ideal gas – physical significances of entropy – Clausius inequality – entropy as criteria of spontaneity and equilibrium. Gibbs function (G) and Helmholtz function (H) as thermodynamics quantities – Gibbs-Helmholtz equation. Need for the third law of thermodynamics – Nernst heat Theorem – statement of the third law of thermodynamics and its applications.

UNIT– III: Photochemistry

Definition of photochemical reactions – comparative study of thermal and photochemical reactions – laws of photochemistry – Lambert and Beer Law – Grothus – Draper law – Stark – Einstein law – quantum efficiency and its determination – Jablonski diagram – Photophysical processes – fluorescence phosphorescence and other deactivating processes.

Photochemical processes – kinetics of photochemical reactions – Photochemical equilibrium – flash photolysis – photosensitization chemiluminescence – bioluminescence.

UNIT – IV: Electrochemistry - I

Specific conductance – equivalent conductance – variation of equivalent conductance with dilution – Migration of ions - Kohlrausch's law – Arrhenius theory of electrolyte dissociation and its limitations - Ostwald's dilution law – Debye Huckel - Onsagar's equation for strong electrolytes (elementary treatment only) – Definition of transport number – determination by Hittorfs method – Application of conductivity measurements – conductometric titrations – HCl Vs NaOH, CH₃COOH Vs NaOH.

UNIT– V: Electrochemistry - II

Single electrode potential, sign convention, Reversible and irreversible cells, conditions for a cell to be a reversible and irreversible – Nernst Equation – Reference electrode, Standard Hydrogen electrode, calomel electrode, Indicator electrode, metal – metal ion electrode, Inert electrode, Determination of EMF of cell, Applications of EMF measurements. Potentiometric titrations – HCl Vs NaOH and K₂Cr₂O₇ Vs FeSO₄

Text Book:

1. Puri. B.R, Sharma. L.R and Pathania. S, Principles of Physical Chemistry, 47th Edition, Shoban Lal Nagin Chand & Co., 2017.

Reference Books:

1. Gilbert W. Castellan, Physical Chemistry, 3rd Edition, Narosa Publishing House, 1985.
2. S. Glasstone, Textbook of Physical Chemistry, McMillan and Co., 1974, London.
2. Soni. P.L and Dharmarha, Textbook of Physical Chemistry, S. Chand & Co., 1991, New Delhi.
3. ArunBahl, B.S. Bahl and Tuli. G.D, Essentials of Physical Chemistry, S. Chand & Co., 2014, New Delhi.
3. Dogra. S.K and Dogra. S, Physical Chemistry through Problems, 4th Edition, New Age International, 1996.



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF CHEMISTRY
(For those who joined in 2018-2019 and after)

Programme : UG	Part III : Core
Semester : VI	Hours : 03
Subject Code : 18UCHCP3	Credits : 06

PHYSICAL CHEMISTRY EXPERIMENTS (PRACTICAL)

Course outcomes:

On successful completion of the course, the learners should be able to:

CO1: Recall the molecular weight of chemical compounds and discuss the determination of molecular weight by various methods. [K1 & K2]

CO2: Determine the CST of phenol-water system, cell constant and conductivity titrations. [K3]

CO3: Inspect the phase diagram involving simple eutectic and compound formation. [K4]

CO4: Interpret the relative strength of acids by hydrolysis of ester [K5]

CO5: Predict the effect of impurity on CST of phenol-water system. [K6]

I. Determination of Molecular weight by

- Transition Temperature method – Sodium thiosulphate pentahydrate
- Rast Macro method – Naphthalene as Solvent

II. Phase diagram involving

- Simple eutectic
- Compound formation

III. Critical solution temperature (CST)

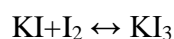
Determination of CST of phenol – water system and effect of impurity on CST –
Determination of Strength of NaCl.

IV. Potentiometric titrations

- HCl Vs NaOH
- $K_2Cr_2O_7$ Vs $FeSO_4$.

V. Partition Coefficient experiments:

- Study of the equilibrium constant for the reaction



By determining the partition Co-efficient of I_2 between water and CCl_4

Determination of strength of given KI.

VI. Kinetics: Determination of relative strength of acids by hydrolysis of ester.

VIII. Conductivity: Determination of cell constant and conductivity titration between an acid and a base (HCl Vs NaOH)

Text Book:

1. Thomas. A.O and Mani, Textbook of Practical Chemistry, 4th Revised Edition, Scientific Publication, 1976.

Distribution of Marks (Max. marks – 100)

Duration of examination: 6 hrs

Regular Test in the Class	: 30 Marks
Observation note book	: 10 Marks

Total	: 40 Marks

Viva voce	: 10 marks
Record Note book	: 10 marks
For completion of the experiment	: 20 marks
Graph	: 2 marks
Calculation	: 5 marks
Tabulation	: 3 marks
Result	: 10 marks

Total	: 60 marks



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)

DEPARTMENT OF CHEMISTRY

(For those who joined in 2018-2019 and after)

Programme :UG

Semester : VI

Subject Code : 18UCHCP4

Part III : Core

Hours : 03

Credits : 05

GRAVIMETRIC ANALYSIS AND ORGANIC PREPARATION (PRACTICAL)

Course outcomes:

On successful completion of the course, the learners should be able to:

CO1: Relate and classify between gravimetric analysis and organic preparation [K1 & K2]

CO2: Estimate lead, barium, calcium, copper and nickel. [K3]

CO3: Analyze the various types of organic preparation. [K4]

CO4: Interpret the organic preparation like nitration, bromination, hydrolysis, oxidation, benzylation and acetylation. [K5]

CO5: Assemble the analyzed and prepared organic compounds samples. [K6]

1. Gravimetric Analysis

1. Estimation of lead as lead chromate
2. Estimation of barium as barium chromate
3. Estimation of calcium as calcium oxalate monohydrate
4. Estimation of copper as cuprous thiocyanate
5. Estimation of nickel as Ni DMG.

2. Organic Preparation

1. Nitration
 - i. M-dinitrobenzene from nitrobenzene
 - ii. Picric acid from phenol
2. Bromination: p-bromoacetanilide from acetanilide
3. Hydrolysis : Aromatic acid from (a) an ester (b) an amide
4. Oxidation: Benzoic acid from benzaldehyde.
5. Benzoylation: (a) Amine (b) phenols.
6. Acetylation : (a) Amine (b) phenols

Text Books:

1. Thomas. A.O and Mani, Textbook of Practical Chemistry, 4th Revised Edition, Scientific Publication, 1976.
2. Gnanapragasam. N.S and Ramamurthy.G, Organic Chemistry Lab Manual, Viswanath. S Printers & Publishers Pvt. Ltd., Chennai, 2010.

Distribution of Marks (Max.marks – 100)

Duration of examination: 6 hrs

Int: 40

Regular Test in the Class : 30 Marks

Observation note book : 10 Marks

Total : 40 Marks

Record Note Book - 10 Marks

Viva Voce - 10 Marks

Ext: 60

Organic preparation (10 Marks)

Gravimetric Estimation (30 Marks)

Procedure - 2 Marks

Crude sample - 6 Marks

Recrystallised sample - 2 Marks

Procedure - 10 Marks

Estimation - 20 Marks

Less than 2 % Error – 20 Marks

2-3% Error – 18 Marks

3-4% Error – 16 Marks

4-5% Error – 14 Marks

Greater than 5% Error – 8 Marks



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)

DEPARTMENT OF CHEMISTRY

(For those who joined in 2018-2019 and after)

Programme : UG	Part III	:Core
Semester : VI	Hours	: 02
Subject Code : 18UCHCP5	Credits	: 04

ORGANIC ANALYSIS AND ESTIMATION (PRACTICAL)

Course outcomes:

On successful completion of the course, the learners should be able to:

CO1: State functional group and classify the organic compounds containing one or two functional groups. [K1 & K2]

CO2: Estimate the organic compound like phenol, aniline and glucose. [K3]

CO3: Distinguish between organic analysis and organic estimation. [K4]

CO4: Justify the conformation by the preparation of a solid derivative. [K5]

CO5: Assemble the analyzed and estimated given organic compounds. [K6]

I. Organic Analysis

Analysis of an organic compound containing one or two functional groups and confirmation by the preparation of a solid derivative – acids, phenols, aldehydes, ketone, esters, nitro compounds, amines (primary, secondary and tertiary), aniline, aliphatic diamide, side chain and nuclear halogen compounds, diamide containing sulphur and monosaccharide.

II. ORGANIC ESTIMATION

1. Estimation of phenol
2. Estimation of aniline
3. Estimation of glucose

Text Books:

1. Thomas. A.O and Mani, Textbook of Practical Chemistry, 4th Revised Edition, Scientific Publication, 1976.
2. Gnanapragasam. N.S and Ramamurthy. G, Organic Chemistry Lab Manual, Viswanath.S Printers & Publishers Pvt. Ltd., 2010, Chennai.

Distribution of Marks (Max.marks – 100)

Duration of examination: 6 hrs

Regular Test in the Class	: 30 Marks
Observation note book	: 10 Marks

Total	: 40 Marks

Organic estimation (30 Marks)

Record Note	- 10 marks
Procedure	- 5 marks
Estimation	- 15 marks
Less than 3% Error	- 15 Marks
3-4% Error	- 13 Marks
4-5% Error	- 10 Marks
Greater than 5%	- 8 Marks

Organic analysis (30 Marks)

Viva Voce	- 10 marks
Preliminary reaction	- 2 marks
Elements present	- 4 marks
Aliphatic or aromatic	- 3 marks
Saturated / Unsaturated	- 3 marks
Functional group	- 6 marks
Derivative	- 2 marks



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)

DEPARTMENT OF CHEMISTRY

(For those who joined in 2018-2019 and after)

Class : B.Sc., Chemistry

Part III : Allied

Semester : VI

Hours : 06

Subject Code: 18UMCA62

Credits : 04

ALLIED MATHEMATICS – IV

Course outcomes:

CO1: To develop skills in Bilinear transformations.

CO2: To introduce different techniques of finding Analytic functions.

CO3: To familiarize concepts of Matrices.

CO4: To teach various types of Groups through examples.

Unit-I

Bilinear Transformations: Elementary Transformations - Bilinear Transformations – Cross Ratio – Fixed points of Bilinear Transformations.

Unit-II

Analytic Functions: Introduction - Analytic Functions – Alternate forms of C-R equations.

Unit -III

Matrices: Matrices – Simultaneous Linear Equations – Cayley Hamilton Theorem – Eigenvalues and Eigenvectors (Problems only).

Unit-IV

Groups: Definition and Examples - Elementary Properties of Group - Permutation Groups.

Unit – V

Subgroups - Cyclic Groups.

Text Book:

1. Dr S.Arumugam and A.Thangapandi Isaac, **Ancillary Mathematics Volume III (Revised)**, New Gamma publishing House, Palayamkottai, 2002.

Unit I - Chapter 1: Sections: 1.0 – 1.4

Unit II - Chapter 2: Sections: 2.0, 2.2, 2.3

Unit III - Chapter 7: Sections: 7.0 – 7.4

Unit IV - Chapter 8: Sections: 8.1, 8.2, 8.4

Unit V – Chapter 8: Sections: 8.5, 8.6.

Reference Books:

1. Dr.S.Arumugam, A. Thangapandi Isaac and A.Somasundaram, **Complex Analysis**, Scitech Publication, Chennai, 2003.
2. Dr.S.Arumugam A.Thangapandi Isaac and A.Somasundaram, **Modern Algebra**, Scitech Publication, Chennai, Reprint July 2008.
3. B.Choudhary, **The Elements of Complex Analysis**, New Age International Publishers, New Delhi, 2009.



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF CHEMISTRY
(For those who joined in 2018-2019 and after)

Programme : UG

Semester : VI

Subject Code : 18UCHE61

Part III : Elective

Hours : 04

Credits : 04

APPLIED CHEMISTRY

Course outcomes:

On successful completion of the course, the learners should be able to:

CO1: Define insecticides, pesticides, petrochemicals and fertilizers and discuss their classification. [K1 & K2]

CO2: Determine water quality, raw materials needed for match and silicate industries. [K3]

CO3: Distinguish between water and sewage treatment and chemicals used between petrochemicals and paints and lacquers. [K4]

CO4: Interpret the preparation of domestically useful chemical products. [K5]

CO5: Integrate the method of sewage treatment and fertilizer industries in India. [K6]

UNIT – I: Water and Sewage Treatment

Water Treatment: Water Quality Analysis – Chemical and Physical Analysis of water - Quality Parameters – Standards prescribed for Water Quality by WHO and other Indian standards – Sea Water as a source of Drinking Water – Electro dialysis method and Reverse osmosis method for purifications of water. **Sewage Treatment:** Municipal Waste Water – Sewage Treatment – Aerobic and Anaerobic process – Miscellaneous Method of Sewage Treatment

UNIT – II: Insecticides, Pesticides and Preparation of Chemicals

Insecticides and Pesticides: Definition – Classification – Inorganic pesticides: lead arsenate, Paris green, lime, sulphur, hydrocyanic acid – Organic pesticides, natural, synthetic (DDT, Gammaxene) – Fungicides – repellants. **Preparation of domestically useful chemical products:** Washing powder – Cleaning powder – Phenoyls (White, Black and Coloured) Shampoo, Liquid Blue, Blue, Red and Green inks, Soap Oil, Face powder, pain balm.

UNIT – III: Match and Silicate Industry

Match Industry: Pyrotechnics and explosives – Raw materials needed for match industry – Manufacturing process – Pyrotechniques – Coloured smokes. **Silicate Industry:** Cement Glass and Ceramics, Raw materials and manufacture of Cement, Glass and Ceramics.

UNIT – IV: Petrochemicals and Lacquer Paint

Petrochemicals: Elementary study – Definition – Origin – Composition – Chemicals from natural gas, Petroleum, Light Naphtha and Kerosene – Synthetic Gasoline. **Paints and lacquers:** Pigments – Paints – Ingredients in Paints – Manufacture – Lacquers – Varnishes.

UNIT – V: Fertilizers

Definition – nutrients for plants – role of various elements in plants growth – natural and chemical fertilizers-classification of chemical fertilizers –urea, super phosphate and potassium nitrate-mixed fertilizer-fertilizer industry in India.

Text Book:

1. Sharma. B.K, Industrial Chemistry including Chemical Engineering, Goel Publishing House – 13th Revised and enlarged Edition, 2009, New Delhi.

Reference Books:

1. Srilakshmi. B, Food Science, 3rd Edition, New Age International Pvt. Ltd., Publishers, 2002.
2. Jayashree Ghosh, Fundamental concepts of Applied Chemistry, S. Chand & Co., Publishers, 1998.
3. Thanamma Jacob, Text Books of Applied Chemistry for Home Science and Allied Sciences, Macmillan, 2000.



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DEPARTMENT OF CHEMISTRY
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Programme :UG

Semester : VI

Subject Code : 18UCHE62

Part III : Elective

Hours : 04

Credits : 04

NANO CHEMISTRY

Course outcomes:

On successful completion of the course, the learners should be able to:

CO1: Define nanotechnology and nanosensors and elaborate the synthesis in confined media. [K1 & K2]

CO2: Estimate the synthesis of quantum dots, Nobel metal materials on its electronic structure of nanocrystals. [K3]

CO3: Differentiate between nanotechnology and biology and between biomolecules and nanoparticles. [K4]

CO4: Interpret the electrochemical sensors – Sensor based on physical properties. [K5]

CO5: Compute nanoshells and nanotechnology in diagnostics applications. [K6]

UNIT – I: Investigating and Manipulating Materials in the Nanoscale

Introduction – difference between nanotechnology and biology – electronic microscopies – scanning electron microscopy (SEM) - TEM.

UNIT – II: Semiconductors Quantum Dots

Introduction – synthesis of quantum dots – synthesis in confined media – molecular precursors. – Electronic structure of nanocrystals – How does we study quantum dots
Uses.

UNIT – III: Nanobiology

Interaction between biomolecules and nano particles surfaces – Nobel metal materials – semiconductor – Nanocrystals – Magnetic nanoparticles – Application of nanobiology.

UNIT – IV: Nanosensors

What is sensor – What make them possible – Electrochemical sensors – Sensor based on physical properties – Nano biosensors – Smart dust – Sensors of the future.

UNIT V: Nanomedicine

Nanoshells – Nanopores – Tectodendrimers – Nanotechnology in diagnostics application – Gold nanoparticles - Magnetic nano particles.

Text Book:

1. Pradeep. T, Nano the essential, Tata McGraw Hill Co., 2007, New Delhi.

Reference Books:

1. Kenneth J. Klabunde, Nanoscale Materials in Chemistry, Wiley Interscience – John Wiley & Sons Inc., New York, 2003.
2. Edelstein.A.S and Cammarata.R.C, Nanomaterials- Synthesis, Properties and Applications, Institute of Physics Publishing, 1998, London.
3. Ozin.G and Arsenault. A, Nanochemistry: A Chemical Approach to Nanomaterials, RSC Publishing, 2005.
4. Edward L. Wolf, Wiley-VCH, Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience, 2nd Reprint, 2005.



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)

DEPARTMENT OF CHEMISTRY

(For those who joined in 2018-2019 and after)

Programme : UG

Semester : VI

Subject Code : 18UCHE63

Part III : Elective

Hours : 04

Credits : 04

FUNDAMENTALS OF COMPUTER AND GREEN CHEMISTRY

Course outcomes:

On successful completion of the course, the Students will able to:

CO1: State the characteristics, features of computer and discuss the parts of computer and fundamentals of green chemistry. [K1 & K2]

CO2: Identify the types of memory, salient features of windows and MS word and need for green chemistry. [K3]

CO3: Analyze the programming languages and evolution of green chemistry. [K4]

CO4: Interpret the parts of computer and basic concept of creating and accessing databases using MS access. [K5]

CO5: Justify the drawing chemical structure and pasting them in the text and environmental protection laws, changes ahead for a chemist. [K6]

UNIT – I: Characteristics of Computer

Introduction to computer – Characteristics – Types of computer – Parts of computer – Input devices – Output devices.

UNIT – II: Types of Memory and System

Memory unit – types of memory – Hardware –Software – Algorithm – Flowchart – Programming languages – Number system – Decimal – Binary system – Octal number system

UNIT – III: Salient Features of Windows and MS word

Salient features of windows and MS word for typing texts and equation in Chemistry – Tabular columns – Advanced concepts. Basic concept of creating and accessing databases using MS access – Significance of chemdraw – Drawing chemical structure and pasting them in the text.

UNIT – IV: Introduction to Green Chemistry

Introduction to Green Chemistry – The need for Green Chemistry – Sustainability and cleaner production – Green Chemistry and Eco-efficiency – Environmental protection laws, changes ahead for a chemist – Green Chemistry education.

UNIT – V: Fundamentals of Green Chemistry

Introduction, Inception and evolution of Green Chemistry, Introduction – Twelve Principles of Green Chemistry – Atom economy Scope of Green Chemistry

Text Books:

1. ArunBahl, B.S. Bahl and G.D. Tuli, Essentials of Physical Chemistry, S. Chand & Co., 2003, New Delhi.
2. RashmiSanghi and M.M. Srivastave, Green Chemistry, Narosa Publishing House, 2003.

Reference Books:

1. Raman. K.V, Computers in Chemistry, Tata McGraw Hill Publishing Co., 1993, New Delhi.
2. Venit. S.M, Programming in Basic: Problem solving with structure and style.Jaico Publishing House: 1996, Delhi.
3. Engel. T and Reid. P, Physical Chemistry 2ndEdition Pearson, 2010.



MANNAR THIRUMALAI NAICKER COLLEGE (Autonomous)
DEPARTMENT OF CHEMISTRY
(For those who joined in 2018-2019 and after)

Programme :UG	Part IV	: Skill
Semester : VI	Hours	: 02
Subject Code : 18UCHS61	Credits	: 02

MACROMOLECULAR CHEMISTRY

Course outcomes:

On successful completion of the course, the learners should be able to:

CO1: Quote and outline the different mechanisms involved in the polymer (K1&K2)

CO2: Construct different types of polymerization techniques (K3)

CO3: Illustrate in detail about the change in temperature(K4)

CO4: Evaluate the factors influencing polymerization (K5)

CO5: Design feasibility and the extent the application of polymer (K6)

UNIT – I: Basic concepts of polymers

Definition – Polymerization - Monomer - Repeat unit - degree of polymerization - Classification of polymers -Stereochemistry of polymer - Nomenclature of stereo regular polymers - Chain polymerization, free radical polymerization - Ionic polymerization.

UNIT – II: Types of Polymerization

Coordination polymerization - Ziegler Natta catalyst. Step polymerization - Ring opening polymerization. Copolymerization - Random, block and graft co polymers - Polymerization techniques; bulk, solution, suspension and emulsion polymerization.

UNIT – III: Molecular Weight and Glass Transition Temperature

Measurement of molecular weight and size - Number average and weight average molecular weights - Glass transition temperature- Concepts of glass transition temperature and associated properties.

UNIT – IV: Glassy Solids and Polymer Crystallization

Glassy solids and glass transition - factors influencing glass transition temperature (T_g). Crystallinity in polymers - Polymer crystallization, structural and other factors affecting crystallisability - effect of crystallinity on the properties of polymers.

UNIT – V: Types of Polymers and Polymer Degradation

Synthetic resins and plastics - Manufacture and applications of polyethylene, PVC, Teflon, poly styrene, polymethylmethacrylate, poly urethane, phenol – formaldehyde resins, urea-formaldehyde resins and epoxy polymers.

Text Book:

1. Gowariker. R.V, Polymer Science, New Age International Publication, 2006.

Reference Books:

1. Young. R.J and Powell. P.A, Introduction to Polymers, 3rd Edition, CRC Press, 1991.
2. Ravve. A, Principles of Polymer Chemistry, 3rd Edition, Springer, 2012, New York.
3. Fred W. Billmeyer, Textbook of Polymer Science, 3rd Edition, John Wiley & Sons, 2007.