



P.R.Govt.College (A), Kakinada

(Affiliated to Adikavi Nannaya University)

Department of chemistry

B.Sc. Chemistry Syllabus under CBCS

Board of studies

2017-18

P.R.Govt. College (A), Kakinada

Recommended Composition of the Board of Studies of Chemistry

And it's Functions of an Autonomous College

April-2017-18

I Composition

1. Head of the Department concerned (Chairman):

Sri E.V.S. Subrahmanyam, M.Sc., M.Phil, B.Ed

2. The entire faculty of each specialization.

1. Dr. M. Mahaboob Pacha, M.Sc., M.Phil, PhD.
2. Sri T.Vara Prasad, M.Sc., M.Phil., M. Ed.,
3. Sri D.Rama Rao, M.Sc., B. Ed., M.Phil.
4. Sri V.Mallikarjuna Sarma,MSc, M.Phil,NET

3. Two experts in the subject from outside the college to be nominated by the Academic Council

1. Dr. V .Sambasivarao, Lecturer in Chemistry, Arts College,
Rajahmundry

2. Dr. K . Jhansi, Lecturer in Chemistry, Ideal Degree College,
Kakinada

4. One expert to be nominated by the Vice-Chancellor from a panel of six recommended by the College Principal

1. Prof. K. Deepti, Adikavi Nannaya University, Rajahmundry

5. One representative from industry/ Corporate Sector/ allied area relating to Placement.

1. Dr. N.Krishna Prakasam, Facility Manager,SAR CHANDRA
ENVIRON SOLUTIONS PVT.LTD.KAKINADA

6. One postgraduate meritorious alumnus to be nominated by the Principal.

The chairman, Board of Studies, may with the approval of the Principal of the College, Co-opt.

1. Sri. Nemani Ramam, M.Sc., M.Phil

II. Term.

The term of the nominated members shall be two years.

III. Meeting

The Principal of the College shall draw the schedule for meeting of the Board of Studies for different Departments. The meeting may be scheduled as and when necessary but at least once a year.

IV. Functions

The Board of Studies of a Department in the College shall:

- a) Prepare syllabus and various courses keeping in view the objectives of the College interest of the stakeholders and national requirement for consideration and approval of the Academic Council.
- b) Suggest methodologies for innovative teaching and evaluation techniques.
- c) Suggest panel of names to the Academic Council for appointment of examiners.
- d) Coordinate research, Teaching, Extension and other academic activities in the Department/College.

Signatures of the members who attended the

Board of studies in Chemistry.

- | | |
|-------------------------------|--------------------------------------------------------------------------------------------|
| 1. Sri E. V. S. Subrahmanyam | Chairman & Lecturer in Charge |
| 2. Dr. K. Deepti, | University representative
Adikavi Nannaya University
Rajamahendravaram |
| 3. Dr. N. K. Prakasam, | Facility Manager,
Industry representative
SAR Chandra Environ Solutions
Pvt. Ltd. |
| 4. Dr. V. Sambasivarao, | Subject expert
Lecturer in Chemistry,
Govt. Arts College,
Rajamahendravaram |
| 5. Dr. K. Jhansi Lakshmi | Subject expert
Lecturer in Chemistry,
Ideal Degree College, Kakinada |
| 6. Sri. N. Ramam | Alumnus, Principal, Retd. |
| 7. Dr. M. Mahaboob Pacha | Member |
| 8. Sri T. Vara Prasad | Member |
| 9. Sri D. Rama Rao | Member |
| 10. Sri V. Mallikarjuna Sarma | Member |

ACTION PLAN BOS MEETING -CHEMISTRY HELD ON 13 -4-2017.

1. Department activities for 2017-2018 academic year. Annexure I

Month	Activity proposed	Faculty member in charge
June-17	Departmental staff meeting to review results and class work allotment	E.V.S.Subrahmanyam
	Preparation of curricular plans, time-tables etc.,	
	Remedial coaching classes for II & III year supplementary exams	
July-17		
	Bridge classes for I year students	
	Student awareness programmes on ragging& eve teasing - consequences , self-discipline, career guidance, higher education opportunities etc.,	T.Vara prasad
August-17	Conference on prospects in pharmaceutical industries	E.V.S.Subrahamanyam
	Study tour / Field trips	
Sept-17	Ozone day	
Oct-17	MOLE Day	D.Ramarao
	Faculty development programme	Dr.M.M.Pacha
Nov-17	11th National Education Day – Out reach Programme to nearby school	
Dec-17	World AIDS Day	
	Chemistry day & Chem fest	V.Mallikarjuna sarma
Jan-18	10 days coaching for PG entrance examinations in chemistry Study tour / Field trips	V.Mallikarjuna sarma
Feb-18	NATIONAL SCIENCE DAY	V.Mallikarjuna sarma
March-18	Consumer awareness day	E.V.S.Subrahamanyam

**2. Organizing National/ State level seminars/Workshops/ Conferences/ Training programmes etc., with topics and other details.
(Mandatory for each Department)**

- i) Staff development programme
- ii) Training in the use of HPLC
- iii) Awareness on OZONE protection
- iv) National Chemistry day
- v) Chem. fest
- vi) National Science day 2018
- vii) Guest lectures
- viii) National seminar in chemistry
- ix) Training in Soil analysis
- x) Training in water analysis

3. Change of modules in the syllabus content.

Syllabus changed for first and second years as per university regulations.
CBCS introduced for final year w.e.f. 2017-18.

4. Plan for utilization of funds for Autonomous/CPE/other grants available for arranging guest lectures, faculty improvement programmes, study tours, equipping laboratories, reference books& other necessary teaching-learning material with ICT enabled teaching.

I. Study visits to:

Rs, 50,000

- 1. Visakha Steel Plant, Visakhapatnam
- 2. Hetero Laboratories, Nakkapally
- 3. Dr. Reddy's Laboratories, Yanam.
- 4. National Institute of Hydrology, Kakinada.
- 5. SAR Chandra Environ Solutions, Kakinada.
- 6. ONGC mini refinery, Tatipaka.
- 7. Soil analysis laboratory, Samalkot.
- 8. IICT, HYD
- 9. Venky parenterals, Yanam

II.

- | | |
|--------------------------------------------------------|-----------|
| 1. Sophisticated version UV-Visible spectrophotometer- | 5.0 lakhs |
| 2. Other equipment | 1.0 lakhs |
| 3. Petrochemicals equipment | 1.0 lakhs |

5. Plan for organizing subject oriented community outreach programmes & allocation of necessary funds. (Mandatory for each Department)

- | | | | |
|-----|------------------------------|-----|--------|
| i) | Adoption of village | Rs. | 20,000 |
| ii) | Medical Awareness programmes | Rs. | 10,000 |

6. Institution of new medals/incentives/prizes etc., from alumni, philanthropists, parents, faculty etc., - Strategies to be recommended

7. Introduction of new programmes –PG/UG/Diploma and certificate courses.

New courses to be proposed.

S.No.	New course proposed	Justification	Employability
1	Under graduate course in Industrial chemistry	There is dearth of skilled persons to operate various instruments like uv visible spectrophotometer, Atomic absorption spectrophotometer, PH meter, flame photometer, rotavapour instrument, HPLC.GLC, distillation, etc which play as key role in any industry related to chemistry.	Technical assistants, Quality control managers, Plant supervisors etc.

8. Any other programme that enhances the learning capacity of students and their employable & knowledge skills.

Training in the use of instruments like AAS, UV-Vis, HPLC, flame photometer, uranium analyzer, soil and water analysis projects, air quality projects.

9. Change in internal assessment exams for conducting II mid Semester by way of Project work/Assignment.

Not possible as the number of students is more. However it is propose to give 33.3% weitage for competitive exam questions pertaining to the syllabus prescribed.

10. Suggest panel of examiners/paper setters & other experts/nominees for BOS deliberations.

Chemistry:

1. Sri N. Lakshmana Rao, SKBR College, Amalapuram.

2. Dr. D. Madhava Sarma, GDC, Tadepalligudem
3. Dr. V. Sambasiva Rao, Govt. Arts College, Rajahmundry.
4. Dr. K. A.R.S.S. Prasad, VS Krishna College, Visakhapatnam.
5. Sri S.V. Ramana, Arts College, Rajahmundry
6. Sri Machi Raju, Arts College, Rajahmundry
7. Smt. C. Jyoti, St. Theresa college, Eluru.
8. P. Krishna kumar, S.K.B.R. College, Amalapuram.
9. Dr. G. Venkatarao, GDC, Vijayavada
10. Shri B. Venkatarao, GDC, Tadepalligudem
11. Dr. Ramchadarao, Y.N. College, Narasapuram

Department of Chemistry BOS Meeting Dt.13 - 4-2017

Resolutions:

Meeting of Board of studies in chemistry is convened on 13-4-17 in the guest room of the College. The Principal Dr. Chappidi Krishna, Dr. K. Deepthi, University Nominee, Dr. N.K. Prakasam, Facility Manager, SAR Chandra Environ Solutions Pvt. Ltd., Dr. V. Sambasiva Rao, Subject Expert, Govt. College, Rajahmundry, Dr. Jhansi, Lecturer in Chemistry, Ideal College, Kakinada, all members of the faculty of Chemistry and student representatives attended the meeting. Agenda items are discussed and resolutions are made.

1. It is resolved to continue Choice based credit system in the Chemistry combination programmes as per the directions of the CCE, Hyderabad to the first year and second year and final year students w.e.f. 2017-18
2. Enhance the internal assessment component from 30% to 40% in theory to first year (admitted batch).
3. It is resolved to allot project works for final year students who opt for project work in chemistry preferably industry based.
4. It is resolved to conduct departmental activities such as Ozone day, Chem fest, Chemistry day and Science day etc.
5. It is resolved to offer subject electives and skill based electives in the V and VI semesters respectively.
6. It is resolved to implement the recommended Pedagogy for the first semester 2017-18.
7. Resolved to conduct practical examinations semester wise.

The following paper setters are recommended.

- i. Dr. V.Sambasiva Rao, Govt.Arts College, Rajahmundry.
- ii. K.A.R.S.S.Prasad, VS Krishna College, Visakhapatnam.
- iii. Sri S.V.Ramana , Arts College, Rajahmundry
- iv. Sri Machi Raju, Arts College, Rajahmundry.
- v. U. Satyanarayana, GDC, Tuni
- vi. R. Brahmaji, GDC, Ramachandrapuram
- vii. N. V. Sudhakar, GDC, Tuni

8. It is resolved to organize Guest lectures by eminent professors.

9. Resolved to implement pass minimum for internal assessment for CBSE pattern students as the pattern is learner oriented.

10. NEW COURSES:

It is resolved to explore the possibility of introducing a new course in B.Sc Pharmaceuticals/Industrial Chemistry as Restructured course.

11. Resolved to submit proposals to conduct a faculty development programme in instrumentation techniques/ advanced topics with the assistance of industry representatives and university representatives.

12. Resolve to assist the orphan children of below two years age being taken by department of Women and Child Welfare as an extension activity with the funds contributed by the faculty members of the department.

13. Resolved to change the syllabus components in semester I to semester II and vice versa. Sly, Semester III to IV and vice versa on par with the affiliating university.

14. It is proposed to give 33.3% weightage for competitive exam questions pertaining to the syllabus prescribed.

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P.R.Govt.College (A), Kakinada

(Affiliated to ADIKAVI NANNAYA UNIVERSITY)

(W.e.f. admitted batch 2017 – 2018)

Department of chemistry

B.Sc. Chemistry Syllabus under CBCS

YEAR	SEMESTER	PAPER	TITLE	MARKS	CREDITS
I	I	I	Inorganic and Organic Chemistry	100	03
			Practical – I	50	02
	II	II	Physical and General Chemistry	100	03
			Practical – II	50	02
II	III	III	Inorganic and organic Chemistry	100	03
			Practical – III	50	02
	IV	IV	Spectroscopy and Physical Chemistry	100	03
			Practical – IV	50	02
III	V	V	Inorganic ,Organic and Physical Chemistry	100	03
			Practical – V	50	02
		VI	Inorganic ,Organic and Physical Chemistry	100	03
			Practical – VI	50	02
	* Any one Paper from VII A, B and C	VII (A)*	Elective	100	03
			Practical - VII A	50	02
		VII (B)*	Elective	100	03
			Practical - VII B	50	02
		VII (C)*	Elective	100	03
			Practical - VII C	50	02

	** Any one cluster from VIII, A, B and C	VIII (A)**	Cluster Electives - I :	100	03
			VIII-A-1	100	03
			VIII-A-2	100	03
			VIII-A-3	50	02
				50	02
				50	02
		VIII (B)**	Cluster Electives - II ::	100	03
			VIII-B-1	100	03
			VIII- B-2	100	03
			VIII-B-3	50	02
				50	02
				50	02
	VI	VIII (C)**	Cluster Electives - III ::	100	03
			VIII-C-1	100	03
			VIII-C-2	100	03
			VIII-C-3	50	02
				50	02
				50	02

FIRST YEAR 2017-18
SEMESTER – I
Paper I - Inorganic & Organic Chemistry
60hrs (4h/w)

OBJECTIVES:

1. Gains knowledge of importance of p-block elements & synthetic applications of organo metallic compounds
2. Understands the role of reagents and reaction mechanism, basics of stereochemistry of organic compounds

INORGANIC CHEMISTRY

30 hrs (2h / w)

UNIT –I

P-block elements –I

15h

Group-13: Synthesis and structure of diborane and higher boranes (B_4H_{10} and B_5H_9), Boron-nitrogen compounds ($B_3N_3H_6$ and BN)

Group - 14: Preparation and applications of silanes and silicones.

Group - 15: Preparation and reactions of hydrazine, hydroxylamine.

UNIT-II

1. p-block elements -II

8h

Group - 16: Classifications of oxides based on (i) Chemical behavior and (ii) Oxygen content.

Group-17: Inter halogen compounds and pseudo halogens.

2. Organometallic Chemistry

7h

Definition - classification of Organometallic compounds - nomenclature, preparation and applications of alkyls of Li and Mg.

ORGANIC CHEMISTRY

30hrs (2h /w)

UNIT-III

Structural theory in Organic Chemistry

10 h

Types of bond fission and organic reagents (Electrophilic, Nucleophilic, and free radical reagents including neutral molecules like H_2O , NH_3 & $AlCl_3$).

Bond polarization: Factors influencing the polarization of covalent bonds, electro negativity - inductive effect. Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance or Mesomeric effect, application to (a) acidity of phenol, and (b) acidity of carboxylic acids. Hyper conjugation and its application to stability of carbonium ions, Free radicals and alkenes, carbanions, carbenes and nitrenes.

Types of Organic reactions: Addition - electrophilic, nucleophilic and free radical. Substitution - electrophilic, Nucleophilic and free radical. Elimination- Examples.

UNIT-IV

1. Acyclic Hydrocarbons

6 h

Alkenes - Preparation of alkenes. Properties: Addition of hydrogen - heat of hydrogenation and stability of alkenes. Addition of halogen and its mechanism. Addition of HX, Markonikov's rule, addition of H_2O , HOX, H_2SO_4 with mechanism and addition of HBr in the presence of peroxide (anti - Markonikov's addition). Dienes - Types of dienes, reactions

of conjugated dienes - 1,2 and 1,4 addition of HBr to 1,3 - butadiene and Diel's - Alder reaction.

Alkynes - Preparation by dehydrohalogenation of dihalides, dehalogenation of tetrahalides, Properties; Acidity of acetylenic hydrogen (formation of Metal acetylides). Preparation of higher acetylenes, Metal ammonia reductions, Physical properties. Chemical reactivity - electrophilic addition of X_2 , HX, H_2O (Tautomerism), Oxidation with $KMnO_4$, OsO_4 , reduction and Polymerisation reaction of acetylene.

2. Alicyclic hydrocarbons (Cycloalkanes)

4 h

Nomenclature, Preparation by Freund's method, Wislicenus method. Properties - reactivity of cyclopropane and cyclobutane by comparing with alkanes, Stability of cycloalkanes - Baeyer's strain theory, Sachse and Mohr predictions and Pitzer's strain theory. Conformational structures of cyclobutane, cyclopentane, cyclohexane.

UNIT-V

Benzene and its reactivity

10h

Concept of resonance, resonance energy. Heat of hydrogenation, heat of combustion of Benzene, mention of C-C bond lengths and orbital picture of Benzene. Concept of aromaticity - aromaticity (definition), Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation)

Reactions - General mechanism of electrophilic substitution, mechanism of nitration, Friedel Craft's alkylation and acylation. Orientation of aromatic substitution - Definition of ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO_2 and Phenolic). Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, carbonyl and sulphonic acid groups (iii) Halogens (Explanation by taking minimum of one example from each type)

List of Reference Books

1. Inorganic Chemistry by J.E.Huheey
2. Basic Inorganic Chemistry by Cotton and Wilkinson
3. A textbook of qualitative inorganic analysis by A.I. Vogel
4. Organic Chemistry by Morrison and Boyd
5. A Text Book of Organic chemistry by I L Finar Vol I
6. Concise Inorganic Chemistry by J.D.Lee

Model paper
Semester-I
Paper-I-Inorganic & organic chemistry

Time 3 hours

Maxmarks-70

Section-A (Inorganic chemistry)

Answer any two questions

2x10=20

Two questions are to be set from unit-I

Two questions are to be set from unit-II

Section-B (Organic chemistry)

Answer any two questions

2x10=20

One question is to be set from unit-III

Two questions are to be set from unit-IV

One question is to be set from unit-V

Section-C

Answer any five questions out of eight

5x4=20

Two questions are to be set from unit-I

Two questions are to be set from unit-II

One question is to be set from unit-III

Two questions are to be set from unit-IV

One question is to be set from unit-V

Section-D

Answer any five questions out of eight

5x2=10

One question is to be set from unit-I

One question is to be set from unit-II

One question is to be set from unit-III

One question is to be set from unit-IV

One question is to be set from unit-V

Weightage to content
Semester-I

Sl.No	Content	Essay(10m)	Short answer(4m)	Very Short answer (2m)
	Inorganic chemistry			
1	Unit-I	2	2	1
2	Unit-II	2	2	1
	Organic chemistry			
3	Unit-III	1	1	1
4	Unit-IV	2	2	1
5	Unit-V	1	1	1
	Total	8	8	5

LABORATORY COURSE-I

30 hrs (2 h / w)

Practical-I Simple Salt Analysis

(At the end of Semester-I) Max marks-50

Qualitative inorganic analysis

Analysis of simple salt containing one anion and cation from the following

Anions: Carbonate, sulphate, chloride, bromide, acetate, nitrate, borate, phosphate.

Cations: Lead, copper, iron, aluminum, zinc, manganese, nickel, calcium, strontium, barium, potassium and ammonium.

Preparation of inorganic compounds:

1. Preparation of pure sample of Ferrous ammonium sulphate (Mohr's salt)
[FeSO₄.(NH₄)₂SO₄.6H₂O]
2. Preparation of pure sample of potash alum [K₂SO₄.Al₂(SO₄)₃.24H₂O]
3. Preparation of pure sample of Tetrammine copper (II) sulphate

**SCHEME OF VALUATION FOR I SEMESTER
CHEMISTRY LABORATORY COURSE**

Max. Marks: 50

Time: 2 hrs.

For Record - 10 Marks

For Viva-Voce - 5 Marks

For Practical - 35 Marks

Splitting of Practical Marks:

S.No.	Description	Marks
1.	Colour	02
2.	State	02
3.	Odour	02
4.	Solubility	03
5.	Flame Test	03
6.	Action of Heat	03
7.	Marks for Anion:	
	Dry test with acid	03
	Confirmation test with SCE	03
	Reporting of Anion	02
8.	Preparation of SCE	04
9.	For Carbonate:	
	Test with acid	03
	Confirmation test with BaCl ₂	03
10.	For Borate:	
	Borontrifluoride test	03
	Ethylborate test	03
11.	For Sulphate:	
	Confirmation test with SCE	03
	Solubility of the formed precipitate	03
12.	Marks for Cation:	
	Identification of cation in correct group	01
	Colour of the precipitate	01
	Mentioning of the group reagents	03
	Confirmation test for the cation	02
	Reporting of Cation	
13.	For Ammonium:	
	Test with NaOH	03
	Confirmation test	03

FIRST YEAR 2017-18
SEMESTER - II
Paper II (Physical & General Chemistry)
60 hrs. (4h/w)

PHYSICAL CHEMISTRY

30 hrs (2h / w)

OBJECTIVES: .1. COMPARES THE VB THEORY AND MOLECULAR ORBITAL THEORY
2. UNDERSTANDS THE PRINCIPLES INVOLVED IN TITRIMETRIC AND GRAVIMETRIC ANALYSIS
3. ABLE TO APPRECIATE THE APPLICATIONS OF COLLOIDS AND ADSORPTION

UNIT-I

Solid state

10h

Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law. Defects in crystals. Stoichiometric and non-stoichiometric defects.

UNIT-II

1.Gaseous state

6 h

Compression factors, deviation of real gases from ideal behavior. Vander Waal's equation of state. P-V Isotherms of real gases, Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. The vander Waal's equation and the critical state. Law of corresponding states. Relationship between critical constants and vander Waal's constants. Joule Thomson effect.

2.Liquid state

4 h

Structural differences between solids, liquids and gases. Liquid crystals, the mesomorphic state. Classification of liquid crystals into Smectic and Nematic. Differences between liquid crystal and solid/liquid. Application of liquid crystals as LCD devices.

UNIT-III

Solutions

10h

Liquid-liquid - ideal solutions, Raoult's law. Ideally dilute solutions, Henry's law. Non-ideal solutions. Vapour pressure - composition and vapour pressure- temperature curves. Azeotropes-HCl-H₂O, ethanol-water systems and fractional distillation. Partially miscible liquids-phenol-water, trimethylamine-water, nicotine-water systems. Effect of impurity on consolute temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

GENERAL CHEMISTRY

30 hrs (2h / w)

UNIT-IV

1.Surface chemistry

8 h

Definition of colloids. Solids in liquids(sols), preparation, purification, properties - kinetic, optical, electrical. Stability of colloids, Hardy-Schulze law, protective colloid.

Liquids in liquids (emulsions) preparation, properties, uses. Liquids in solids (gels) preparation, uses.

Adsorption: Physical adsorption, chemisorption. Freundlich, Langmuir adsorption isotherms. Applications of adsorption

2. Chemical Bonding

7h

Valence bond theory, hybridization, VB theory as applied to ClF_3 , $\text{Ni}(\text{CO})_4$, Molecular orbital theory - LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules (N_2 , O_2 , CO and NO).

UNIT-V

Stereochemistry of carbon compounds

15 h

Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae. Optical isomerism: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation. Chiral molecules- definition and criteria (Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane. D,L and R,S configuration methods and E,Z- configuration with examples.

List of Reference Books

1. Principles of physical chemistry by Prutton and Marron
2. Solid State Chemistry and its applications by Anthony R. West
3. Text book of physical chemistry by K L Kapoor
4. Text book of physical chemistry by S Glasstone
5. Stereochemistry of Organic compounds by E L Eliel
6. Advanced Organic Chemistry by F A Carey and R J Sundberg
7. Stereochemistry by P.S.Kalsi
8. Stereochemistry of Organic compounds by D. Nasipuri
9. Advanced physical chemistry by Bahl and Tuli
10. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan

LABORATORY COURSE -II
Practical-II Analysis of Mixture Salt

(At the end of Semester-II) **30** hrs (2 h / w) Maximum marks-50

Qualitative inorganic analysis

Analysis of mixture salt containing two anions and two cations (From two different groups) from the following:

Anions: Carbonate, sulphate, chloride, bromide, acetate, nitrate, borate, phosphate.

Cations: Lead, copper, iron, aluminum, zinc, manganese, calcium, strontium, barium, potassium and ammonium.

SCHEME OF VALUATION FOR II SEMESTER
CHEMISTRY LABORATORY COURSE

Max. Marks: 50

Time: 3 hrs.

For Record - 10 Marks

For Viva-voce - 5 Marks

For Practical - 35 Marks

Splitting of Practical Marks:

S.No.	Description	Marks
1.	Colour	01
2.	State	01
3.	Odour	01
4.	Solubility	02
5.	Flame Test	02
6.	Action of Heat	02
7.	Marks for each Anion: 06 Marks	
	Dry test with acid	02
	Confirmation test with SCE	03
	Reporting of Anion	01
8.	Preparation of SCE	02
9.	For Carbonate:	
	Test with acid	02
	Confirmation test with BaCl ₂	03
10.	For Borate:	
	Borontrifluoride test	02
	Ethylborate test	03
11.	For Sulphate:	
	Conformation test with SCE	03
	Solubility of the formed precipitate	02
12.	Marks for each Cation: 06 Marks	
	Identification of cation in correct group	01
	Colour of the precipitate	01
	Mentioning of the group reagents	02
	Confirmation test for the cation	01
	Reporting of Cation	
	For Ammonium:	
	Test with NaOH	02
	Confirmation test	03

SECOND YEAR 2017-18

SEMESTER – III

Paper III (INORGANIC & ORGANIC CHEMISTRY) 60 hrs (4 h / w)

INORGANIC CHEMISTRY

30 hrs (2h / w)

OBJECTIVES;

1. Understands the reason for characteristic properties of d and f-block elements
2. Appreciates the application of m.o. theory to conductors, nonconductors and Semiconductors
3. Gains knowledge of properties of hetero compounds with mechanism
4. Able to apply principles of anion synthesis

UNIT –I

1. Chemistry of d-block elements:

9h

Characteristics of d-block elements with special reference to electronic configuration, variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states

2. Theories of bonding in metals:

6h

Metallic properties and its limitations, Valence bond theory, Free electron theory, Explanation of thermal and electrical conductivity of metals, limitations, Band theory, formation of bands, explanation of conductors, semiconductors and insulators.

UNIT – II

3. Metal carbonyls :

7h

EAN rule, classification of metal carbonyls, structures and shapes of metal carbonyls of V, Cr, Mn, Fe, Co and Ni.

4. Chemistry of f-block elements:

8h

Chemistry of lanthanides - electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties. Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides.

ORGANIC CHEMISTRY

30h (2h/w)

UNIT – III

1. Halogen compounds

5 h

Nomenclature and classification of alkyl (into primary, secondary, tertiary), aryl, aryl alkyl, allyl, vinyl, benzyl halides. Nucleophilic aliphatic substitution reaction- classification into SN^1 and SN^2 – reaction mechanism with examples – Ethyl chloride, t-butyl chloride and optically active alkyl halide 2-bromobutane.

2. Hydroxy compounds

5 h

Nomenclature and classification of hydroxy compounds.

Alcohols: Preparation with hydroboration reaction, Grignard synthesis of alcohols. Phenols: Preparation i) from diazonium salt, ii) from aryl sulphonates, iii) from cumene. Physical properties- Hydrogen bonding (intermolecular and intramolecular). Effect of hydrogen bonding on boiling point and solubility in water.

Identification of alcohols by oxidation with $KMnO_4$, Ceric ammonium nitrate, Luca's reagent and phenols by reaction with $FeCl_3$. Chemical properties: a) Dehydration of alcohols. b) Oxidation of alcohols by CrO_3 , $KMnO_4$. c) Special reaction of phenols: Bromination, Kolbe-Schmidt reaction, Reimer-Tiemann reaction, Fries rearrangement, azocoupling, Pinacol-Pinacolone rearrangement.

UNIT-IV

Carbonyl compounds

10 h

Nomenclature of aliphatic and aromatic carbonyl compounds, structure of the carbonyl group. Synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties: Reactivity of carbonyl group in aldehydes and ketones.

Nucleophilic addition reaction with a) NaHSO_3 , b) HCN , c) RMgX , d) NH_2OH , e) PhNHNH_2 , f) 2,4 DNPH, g) Alcohols-formation of hemiacetal and acetal. Base catalysed reactions: a) Aldol, b) Cannizzaro's reaction, c) Perkin reaction, d) Benzoin condensation, e) Haloform reaction, f) Knoevenagel reaction. Oxidation of aldehydes- Baeyer-Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf-Kishner reduction, MPV reduction, reduction with LiAlH_4 and NaBH_4 . Analysis of aldehydes and ketones with a) 2,4-DNPH test, b) Tollen's test, c) Fehling test, d) Schiff's test e) Haloform test (with equation)

UNIT-V

1. Carboxylic acids and derivatives

6 h

Nomenclature, classification and structure of carboxylic acids. Methods of preparation by a) Hydrolysis of nitriles, amides b) Hydrolysis of esters by acids and bases with mechanism c) Carbonation of Grignard reagents. Special methods of preparation of aromatic acids by a) Oxidation of side chain. b) Hydrolysis by benzotrichlorides. c) Kolbe reaction.

Physical properties: Hydrogen bonding, dimeric association, acidity- strength of acids with examples of trimethyl acetic acid and trichloroacetic acid. Relative differences in the acidities of aromatic and aliphatic acids. **Chemical properties:** Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Hunsdiecker reaction, decarboxylation by Schimdt reaction, Arndt-Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction.

2. Active methylene compounds

4h

Acetoacetic ester: keto-enol tautomerism, preparation by Claisen condensation, Acid hydrolysis and ketonic hydrolysis. Preparation of a) monocarboxylic acids. b) Dicarboxylic acids. c) Reaction with urea

Malonic ester: preparation from acetic acid. **Synthetic applications:** Preparation of a) monocarboxylic acids (propionic acid and n-butyric acid). b) Dicarboxylic acids (succinic acid and adipic acid) c) α,β -unsaturated carboxylic acids (crotonic acid). d) Reaction with urea.

List of Reference Books

1. Selected topics in inorganic chemistry by W.D.Malik, G..D.Tuli,R.D.Madan
2. Inorganic Chemistry J E Huheey, E A Keiter and R L Keiter
3. A Text Book of Organic Chemistry by Bahl and Arun bahl
4. A Text Book of Organic chemistry by I L Finar Vol I
5. Organic chemistry by Bruice
6. Organic chemistry by Clayden
7. Advanced Inorganic chemistry by Gurudeep Raj
8. Basic Inorganic Chemistry by Cotton and Wilkinson
9. Concise Inorganic Chemistry by J.D.Lee

LABORATORY COURSE -III **30 hrs. (2 h / w)**
Practical Paper-III Titrimetric analysis & Organic Functional Group Reactions
(At the end of Semester-III)

Titrimetric analysis: **23M**

1. Determination of Fe (II) using KMnO_4 with oxalic acid as primary standard.
2. Determination of Cu (II) using $\text{Na}_2\text{S}_2\text{O}_3$ with $\text{K}_2\text{Cr}_2\text{O}_7$ as primary standard.

Organic Functional Group Reactions **12M**

3. Reactions of the following functional groups present in organic compounds
(at least four) Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids and Amides

**SCHEME OF VALUATION FOR III SEMESTER
CHEMISTRY LABORATORY COURSE**

**TITRIMETRIC ANALYSIS &
ORGANIC FUNCTIONAL GROUP REACTIONS**

Max. Marks: 50

Time: 3 hrs.

For Record - 10 Marks

For Viva-voce - 5 Marks

For Practical - 35 Marks

Splitting of Practical Marks for titrimetric analysis:

- | | | |
|------|------------------------------------------|---------------------------|
| i) | Preparation of standard solution | : 5 Marks |
| ii) | Standardization of intermediate solution | : 5 Marks |
| iii) | Determination of the given compound | : 10 Marks |
| | Error < 1% | : 10 Marks |
| | Error 1-1.5 % | : 8 Marks |
| | Error > 2 % | : 5 Marks (Minimum Marks) |
| iv) | Correct calculation | : 3 marks |

Splitting of Practical Marks for Organic functional group reactions:

Any FOUR reactions of the given functional group: $4 \times 3 = 12$ Marks

SEMESTER IV
Paper IV (SPECTROSCOPY & PHYSICAL CHEMISTRY)
60 hrs (4 h / w)

OBJECTIVES:

1. Understands heterogenous equilibria and the application of phase rule
2. Gains knowledge of principles of electrolysis and galvanic cells
3. Understands the application of colligative properties in the determination of molecular weight
4. Understands the applications of spectrophotometry and spectroscopic interpretations..

SPECTROSCOPY

30 hrs (2h / w)

UNIT-I

6h

General features of absorption - Beer-Lambert's law and its limitations, transmittance, Absorbance, and molar absorptivity. Single and double beam spectrophotometers. Application of Beer-Lambert law for quantitative analysis of 1. Chromium in $K_2Cr_2O_7$ 2. Manganese in Manganous sulphate

Electronic spectroscopy:

8h

Interaction of electromagnetic radiation with molecules and types of molecular spectra. Energy levels of molecular orbitals (σ , π , n). Selection rules for electronic spectra. Types of electronic transitions in molecules effect of conjugation. Concept of chromophore and auxochrome.

UNIT-II

Infra red spectroscopy

8h

Different Regions in Infrared radiations. Modes of vibrations in diatomic and polyatomic molecules. Characteristic absorption bands of various functional groups. Interpretation of spectra-Alkanes, Aromatic, Alcohols carbonyls, and amines with one example to each.

Proton magnetic resonance spectroscopy (1H -NMR)

8h

Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants. Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

PHYSICAL CHEMISTRY

30 hrs (2h / w)

UNIT-III :

Dilute solutions

10h

Colligative properties. Raoult's law, relative lowering of vapour pressure, its relation to molecular weight of non-volatile solute. Elevation of boiling point and depression of freezing point. Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods of determination. Osmosis, osmotic pressure, experimental determination. Theory of dilute solutions. Determination of molecular weight of non-volatile solute from osmotic pressure. Abnormal Colligative properties- Van't Hoff factor.

UNIT-IV

Electrochemistry-I

10h

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-Onsager's equation for strong electrolytes (elementary treatment only). Definition of transport number, determination by Hittorfs method. Application of conductivity measurements- conductometric titrations.

UNIT-V

1. Electrochemistry-II

4h

Single electrode potential, sign convention, Reversible and irreversible cells 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.

2.Phase rule

6h

Concept of phase, components, degrees of freedom. Thermodynamic Derivation of Gibbs phase rule. Phase equilibrium of one component system - water system. Phase equilibrium of two- component system, solid-liquid equilibrium. Simple eutectic diagram of Pb-Ag system, simple eutectic diagram, desilverisation of lead., NaCl-Water system, Freezing mixtures.

List of Reference Books

1. Spectroscopy by William Kemp
2. Spectroscopy by Pavia
3. Organic Spectroscopy by J. R. Dyer
4. Modern Electrochemistry by J.O. M. Bockris and A.K.N.Reddy
5. Advanced Physical Chemistry by Atkins
6. Introduction to Electrochemistry by S. Glasstone
7. Elementary organic spectroscopy by Y.R. Sharma
8. Spectroscopy by P.S.Kalsi

LABORATORY COURSE – IV

**Practical Paper - IV Physical Chemistry and IR Spectral Analysis
(At the end of semester IV)**

30 hrs (2 h / W)

Physical Chemistry

25M

1. Critical Solution Temperature- Phenol-Water system
2. Effect of NaCl on critical solution temperature (Phenol-Water system)
3. Determination of concentration of HCl conducts metrically using standard NaOH solution.
4. Determination of concentration of acetic acid conducts metrically using standard NaOH Solution.

IR Spectral Analysis

10 M

5. IR Spectral Analysis of the following functional groups with examples
- a) Hydroxyl groups
 - b) Carbonyl groups
 - c) Amino groups
 - d) Aromatic groups

**SCHEME OF VALUATION FOR IV SEMESTER
CHEMISTRY LABORATORY COURSE
PHYSICAL CHEMISRY AND IR SPECTRAL ANALYSIS**

Max. Marks: 50

Time: 3 hrs.

For Record - 10 Marks

For Viva-voce - 5 Marks

For Practical - 35 Marks

Splitting of Practical Marks for Physical Chemistry:

- | | | |
|------|---------------------------------|------------|
| i) | Procedure in first five minutes | : 5 Marks |
| ii) | Tabulation of the readings | : 5 Marks |
| iii) | Calculation | : 5 Marks |
| iv) | For result | : 10 Marks |

Error < 10% : 10 Marks

Error 10-15 % : 8 Marks

Error > 20% : 5 Marks (Minimum Marks)

Splitting of Practical Marks for IR spectral analysis:

Identification of the frequencies of the bonds present in the IR spectrum of an organic compound : 10 Marks

Final year 2017-18
SEMESTER-V
Paper - III (INORGANIC, PHYSICAL & ORGANIC CHEMISTRY)
45 hrs (3 h / w)

INORGANIC CHEMISERY

UNIT-I

Coordination Chemistry:

8h

IUPAC nomenclature - bonding theories - Review of Werner's theory and Sidgwick's concept of coordination - Valence bond theory - geometries of coordination numbers 4-tetrahedral and square planar and 6-octahedral and its limitations, crystal field theory - splitting of d-orbitals in octahedral, tetrahedral and square-planar complexes - low spin and high spin complexes - factors affecting crystal-field splitting energy, merits and demerits of crystal-field theory. Isomerism in coordination compounds - structural isomerism and stereo isomerism, stereochemistry of complexes with 4 and 6 coordination numbers.

UNIT-II

1. Spectral and magnetic properties of metal complexes:

4h

Types of magnetic behavior, spin-only formula, calculation of magnetic moments, experimental determination of magnetic susceptibility-Gouymethod.

2. Stability of metal complexes:

3h

Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.

ORGANIC CHEMISTRY

UNIT- III

Nitro hydrocarbons:

3h

Nomenclature and classification-nitro hydrocarbons, structure -Tautomerism of nitroalkanes leading to aci and keto form, Preparation of Nitroalkanes, reactivity - halogenation, reaction with HONO (Nitrous acid),Nef reaction and Mannich reaction leading to Micheal addition and reduction.

UNIT – IV

1. Nitrogen compounds :

12h

Amines (Aliphatic and Aromatic): Nomenclature, Classification into 1°, 2°, 3° Amines and Quarternary ammonium compounds. Preparative methods –

1. Ammonolysis of alkyl halides 2. Gabriel synthesis 3. Hoffman's bromamide reaction (mechanism).Reduction of Amides and Schmidt reaction. Physical properties and basic character - Comparative basic strength of Ammonia, methyl amine, dimethyl amine, trimethyl amine and aniline - comparative basic strength of aniline, N-methylaniline and N,N-dimethyl aniline (in aqueous and non-aqueous medium), steric effects and substituent effects.

Chemical properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation e) Reaction with Nitrous acid of 1°, 2°, 3° (Aliphatic and aromatic amines). Electrophillic substitution of Aromatic amines – Bromination and Nitration. Oxidation of aryl and Tertiary amines, Diazotization.

2. Heterocyclic Compounds

Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1,4,-dicarbonyl compounds, Paul-Knorr synthesis.

Properties : Acidic character of pyrrole - electrophilic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan.

Pyridine – Structure - Basicity - Aromaticity - Comparison with pyrrole - one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.

PHYSICAL CHEMISTRY

UNIT- V

Thermodynamics

15h

The first law of thermodynamics-statement, definition of internal energy and enthalpy. Heat capacities and their relationship. Joule-Thomson effect- coefficient. Calculation of w , for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes. State function. Temperature dependence of enthalpy of formation-Kirchoff's equation. Second law of thermodynamics. Different Statements of the law. Carnot cycle and its efficiency. Carnot theorem. Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes.

List of Reference Books

1. Concise coordination chemistry by Gopalan and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
3. Organic Chemistry by G.Mare loudan, Purdue Univ
4. Advanced Physical Chemistry by
5. Text book of physical chemistry by S Glasstone
6. Concise Inorganic Chemistry by J.D.Lee
7. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
8. A Text Book of Organic Chemistry by Bahl and Arun bahl
9. A Text Book of Organic chemistry by I L Finar Vol I
10. Advanced physical chemistry by Gurudeep Raj

P.R.GOVERNMENT COLLEGE (A), KAKINADA
DEPARTMENT OF CHEMISTRY
BOARD OF STUDIES 2017-18 APRIL- 2016
FIFTH SEMESTER SYLLABUS
PAPER-IV
SKILL BASED ELECTIVE - 1

1. Molecular spectroscopy;

10 h

UNIT-I

Raman spectroscopy: Concept of polarizability, selection rules, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

Mass Spectrometry: Basic principles – Molecular ion / parent ion, fragment ions / daughter ions. Theory – formation of parent ions. Representation of mass spectrum. Identification of parent ion, (M+1), (M+2), base peaks (relative abundance 100%)
Determination of molecular formula – Mass spectra of ethylbenzene, acetophenone, n-butyl amine and 1-propanol.

b) Spectral interpretation: 2h

Interpretation of IR, UV-Visible, ¹H-NMR of the following compounds
1. Phenyl acetylene
2. Acetophenone 3. Cinnamic Acid 4. para-nitro aniline.

UNIT-II

MACROMOLECULES: 10 hours

Classification of polymers, definition and mechanisms of polymerization methods- chain polymerization, step polymerization, coordination polymerization – tacticity.

Co-Polymerization. Molecular weight of polymers-number average and weight average molecular weight, degree of polymerization, determination of molecular weight of polymers by viscometry and Osmometry. Preparation and industrial application of polyethylene, PVC, Teflon, polyacrylonitrile, terelene and Nylon66. Introduction to biodegradability with examples.

Unit III Green Chemistry

8 hours

Introduction: Definition of green Chemistry, need of green chemistry, basic principles of green chemistry

Green synthesis: Evaluation of the type of the reaction i) Rearrangements (100% atom economic), ii) Addition reaction (100% atom economic), Pericyclic reactions (no by-product).

Selection of solvent: i) Aqueous phase reactions ii) Reactions in ionic liquids iii) Solid supported synthesis iv) Solvent free reactions (solid phase reactions)

ii) Green catalysts: 1) Phase transfer catalysts (PTC), 2) Biocatalysts

Microwave and Ultrasound assisted green synthesis:

1. Aldol condensation
2. Cannizzaro reaction
3. Diels-Alder reactions
4. Strecker synthesis
5. Willaimson synthesis
6. Dieckmann condensation

DEPARTMENT OF CHEMISTRY
BOARD OF STUDIES 2017-18 APRIL- 2016
FIFTH SEMESTER SYLLABUS
PAPER-IV
Model paper

Answer any four choosing at least one from each section A,B,C. 4x10=40 Marks

Section-A;

1. Explain the different types of molecular vibrations and interpretation of IR spectrum
 In respect of i) Functional group region ii) finger print region
2. What are equivalent and non equivalent protons? Explain Chemical shift . How is it expressed?
3. Interpret the spectrum of the following as per UV.IR and NMR spectroscopy.
 i) Cinnamic acid ii) phenyl acetylene

Section - B;

4. Define the term polymerization. .Write the mechanism of radical polymerization.
5. How is molecular weight determined by Viscometry method?
6. Write the preparation and applications of i) PVC ii) polyacrylonitrile iii) Nylon 66

Section - C;

7. Enumerate the principles of green chemistry.
8. How is a reaction evaluated in green chemistry? Explain with an example? Give examples of 100% atom economy reactions.
9. Microwave and Ultrasound assisted green synthesis:
 i) Aldol condensation
 ii) Cannizzaro reaction

Section: D

Answer any five of the following questions.

4 x 5 = 20 Marks

10. How does Conjugation affect the λ_{max} of the compounds?
11. What is force constant? How is it related to the bond energies?
12. Explain spin-spin coupling.
13. What is tacticity? Write different types of tacticity.

14. Explain the classification of polymers.

15. Write the names and structures of monomers in (i) Teflon (ii) Terylene

16. Write a note on Phase Transfer Catalysis.

17. What is the need for Green Chemistry?

Section-E

Answer all the following questions.

5 x 2 = 10 Marks

18. What are stokes and anti-stoke lines in Raman Spectrum?

19. Define the terms chromophore and Auxochrome.

20. Define degree of polymerization.

21. What are Ziegler-Natta catalysts?

22. Write a note on biocatalysts.

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FIFTH SEMESTER SYLLABUS
PAPER-IV
SKILL BASED ELECTIVE - 2

ENVIRONMENTAL CHEMISTRY
30 hrs (2 h / w)

UNIT-I

Introduction

9h

Concept of Environmental chemistry-Scope and importance of environment in now a days – Nomenclature of environmental chemistry – Segments of environment - Natural resources – Renewable Resources – Solar and biomass energy and Nonrenewable resources – Thermal power and atomic energy – Reactions of atmospheric oxygen and Hydrological cycle.

UNIT-II

Air Pollution

9h

Definition – Sources of air pollution – Classification of air pollution – Acid rain – Photochemical smog – Green house effect – Formation and depletion of ozone – Bhopal gas disaster – Controlling methods of air pollution.

UNIT-III

Water pollution & Chemical Toxicology

12h

Unique physical and chemical properties of water – water quality and criteria for finding of water quality – Dissolved oxygen – BOD, COD, Suspended solids, total dissolved solids, alkalinity – Hardness of water – Methods to convert temporary hard water into soft water – Methods to convert permanent hard water into soft water – eutrophication and its effects – principal wastage treatment – Industrial waste water treatment. Toxic chemicals in the environment – effects of toxic chemicals – cyanide and its toxic effects –

List of Reference books

1. Fundamentals of ecology by M.C.Dash
2. A Text book of Environmental chemistry by W. Moore and F.A. Moore
3. Environmental Chemistry by Samir k. Banerji

P.R.GOVERNMENT COLLEGE (A), KAKINADA
DEPARTMENT OF CHEMISTRY
BOARD OF STUDIES 2017-18 APRIL- 2016
FIFTH SEMESTER SYLLABUS
PAPER-IV

Elective 2

Model paper

Answer any four choosing at least one from each section A,B,C. **4x10=40 Marks**

SECTION A;

THREE QUESTIONS FROM UNIT I

SECTION B;

THREE QUESTIONS UNIT II

SECTION C;

THREE QUESTIONS FROM UNIT III

SECTION: D

4x5 = 20

TWO QUESTIONS FROM UNIT I

TWO QUESTIONS FROM UNIT II

FOUR QUESTIONS FROM UNIT III

SECTION-E

2x5= 10

ONE QUESTION FROM UNIT I

ONE QUESTION FROM UNIT II

THREE QUESTIONS FROM UNIT III

SEMESTER V
LABORATORY COURSE – V
Practical Paper – V Organic Chemistry
(at the end of semester V)

30 hrs (2 h / W)

Organic Qualitative Analysis:

50M

Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable derivatives.

Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic Primary Amines, Amides and Simple sugars.

LABORATORY COURSE – VI
Practical Paper – VI Physical Chemistry
(at the end of semester V)

30 hrs (2 h/W)

1. Determination of rate constant for acid catalyzed ester hydrolysis.
2. Determination of molecular status and partition coefficient of benzoic acid in Benzene and water.
3. Determination of Surface tension of liquid
4. Determination of Viscosity of liquid.
5. Potentiometry- Determination of Fe (II) with Potassium dichromate

FINAL YEAR-2017-18
SEMESTER – VI
CHEMISTRY III MODEL PAPER 2017-18
(INORGANIC, ORGANIC & PHYSICAL CHEMISTRY)

Time: 3 Hrs.

Max. Marks: 70

PAPER III

OBJECTIVES:

1. Gains knowledge Labile and Inert complexes
2. Knowledge of Biological significance of inorganic elements
3. Structure of Carbohydrates
4. Synthesis of amino acids.

INORGANIC CHEMISTRY

Reactivity of metal complexes: Labile and inert complexes, Mechanism of ligand substitution reactions in octahedral complexes- SN^1 and SN^2 reactions, ligand substitution reactions in square planar complexes- Trans effect and applications of Trans effect.

Stability of metal complexes: Thermodynamic stability and kinetic stability- factors affecting the stability of complexes- chelate effect- determination of the composition of the complex by Job's method and mole-ratio method.

Hard and Soft acids and bases: Classification, Pearson's concept of hardness and softness- HSAB Principle and applications of HSAB Principle-stability of complexes, predicting the feasibility of a reaction.

Bioinorganic Chemistry: Essential elements- biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and Chloride (Cl^-). metalloporphyrins -hemoglobin, structure and function, chlorophyll, structure and role in photosynthesis.

ORGANIC CHEMISTRY

Carbohydrates: Monosaccharide's: All discussion to be confined to (+) glucose as an example of aldo hexoses and (-) fructose as example of ketohexoses. Chemical properties and structural elucidation: Evidences for straight chain pentahydroxy aldehyde structure (Acetylation, reduction to n-hexane, cyanohydrin formation, reduction of Tollen's and Fehling's reagents and oxidation to gluconic and saccharic acid). Number of optically active isomers possible for the structure, configuration of glucose based on D-glyceraldehydes as primary standard (no proof for configuration is required). Evidence for cyclic structure of glucose (some negative aldehydes tests and mutarotation). Cyclic structure of glucose. Decomposition of cyclic structure (Pyranose

structure, anomeric carbon and anomers). Proof for the ring size (methylation, hydrolysis and oxidation reactions). Different ways of writing pyranose structure (Haworth formula and chair conformational formula). Structure of fructose: Evidence of 2 – ketohexose structure (formation of penta acetate, formation of cyanohydrin its hydrolysis and reduction by HI to give 2-Carboxy-n-hexane). Same osazone formation from glucose and fructose, Hydrogen bonding in osazones, cyclic structure for fructose (Furanose structure and Haworth formula).

Interconversion of Monosaccharide: Aldopentose to aldohexose – eg: Arabinose to D-Glucose, D-Mannose (Kiliani - Fischer method). Epimers, Epimerisation – Lobry de bruyn van Ekenstein rearrangement. Aldohexose to Aldopentose eg: D-glucose to D-arabinose by Ruff's degradation. Aldohexose (+) (glucose) to ketohexose (-) (Fructose) and Ketohexose (fructose) to aldohexose (Glucose).

Amino acids and proteins:

Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids – definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples – Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Malonic ester synthesis c) strecker's synthesis. Physical properties: Optical activity of naturally occurring amino acids: L configuration, irrespective of sign rotation, Zwitterion structure – salt like character- solubility, melting points, amphoteric character, definition of isoelectric point. Chemical properties: General reactions due to amino and carboxyl groups – lactams from gamma and delta amino acids by heating peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.

PHYSICAL CHEMISTRY;

1. Chemical kinetics: Rate of reaction, factors influencing the rate of a reaction concentration, temperature, pressure, solvent, light, catalyst. Experimental methods to determine the rate of reaction. Definition of order and molecularity. Derivation of rate constants for first, second, third and zero order reactions and examples. Derivation for time half change. Methods to determine the order of reactions. Kinetics of complex reactions (first order only): opposing reactions, parallel reactions, consecutive reactions and chain reactions. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Theories of reaction rates- collision theory-derivation of rate constant for bimolecular reaction. The transition state theory (elementary treatment).

2. Photochemistry. Difference between thermal and photochemical processes. Laws of

photochemistry-Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence.

Quantum yield. Ferrioxalate actinometry. Photochemical hydrogen- chlorine, hydrogen-bromine reaction. Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing). Photosensitized reactions- energy transfer processes (simple example)

III YEAR B.Sc (Examination at the end of VI Semester) Model Paper
PAPER-III (INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY)

Time: 3 Hrs.

Max. Marks: 70

Answer any **FOUR** questions choosing at least **ONE** question from each section.

SECTION-I

4 X 10 = 40 Marks

1. Explain the mechanism of the ligand substitution reactions (SN^1 and SN^2) in octahedral complexes.
2. Explain the determination of composition of complex by Job's method.
3. (i) Explain the biological significance of Mg and Fe.
 (ii) Explain the structure of chlorophyll and its role in photosynthesis.

SECTION-II

4. Explain (i) Killiani-Fischer Synthesis (ii) Ruff degradation
5. What are amino acids? Write their classification. Give any two methods of preparation of amino acids.
6. Write the objections of open chain structure of glucose and explain the ring structure of glucose.

SECTION-III

7. (i) Derive an expression for the rate constant of a first order reaction.
 (ii) In a first order reaction, 10% of the reactants are consumed in 30 minutes. Calculate the time required for 90% completion of the reaction.
8. Explain any three methods of determination of order of a reaction.
9. What is meant by "Quantum yield of a chemical reaction". The quantum yield for the reaction $H_2 + Cl_2 \rightarrow 2 HCl$ is very high. Explain.

SECTION-IV

Answer any **FIVE** of the following questions.

5 X 4 = 20 Marks

10. Explain any two factors affecting the stability of complexes.
11. Write HSAB principle and its applications.
12. Write the structure and biological functions of hemoglobin.
13. Write the equations of the osazone formation from glucose and fructose.
14. What is Zwitter ion? Write the salt like properties of amino acids.
15. Write a note on the structure of proteins.
16. Write a note on transition state theory.
17. Write a note on (i) Fluorescence and (ii) Phosphorescence
18. Explain any two factors influencing the rate of a reaction.

SECTION-V

Answer **ALL** the following questions.

19. What are hard acids? Give examples.
20. What is meant by Chelate effect?
21. What are epimers and anomers?
22. Define isoelectric point.
23. State Grothus-Draper law.

FINAL YEAR-2017-18
VI semester syllabus IV Paper 2017-18
ELECTIVE -1

Unit I

1. DRUGS

10h

- a. Introduction:** Drug, disease (definition), Historical evolution, Sources – Plant, Animal synthetic, Biotechnology and human gene therapy
- b. Terminology:** Pharmacy, Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics (ADME, Receptors – brief treatment) Metabolites and Anti metabolites.
- c. Nomenclature:** Chemical name and Generic name
- d. Classification:** Classification based on structures and therapeutic activity with one example each.
- e. Synthesis:** Synthesis and therapeutic activity of the following drugs, L-Dopa, Chloroquin, Omeprazole, Paracetamol, Sulphamethoxazole. ciproflaxacin., salbutamole
- f. Drug Development:** Pencillin, Separation and isolation, structures of different penicillin's.
- g. HIV-AIDS:** Immunity – CD-4 cells, CD-8 cells Retrovirus, replication in human body. Investigation available, prevention of AIDS. Drugs available – examples with clinical uses: PIS: Indinavir (Crixivan), Nelfinavir (Viracept), NNRTIS: Efavirenz (Susrtiva), Nevirapine (Viramune) NRTIs: Abacavir (Ziagen), Lamivudine (Epivir, 3TC) Zidovudine (Retravir, AZT, ZDV)

2. Formulations:

2h

- 1. Need of conversion of drugs into medicine. Additives and their role (brief account only)
- 2. Different types of formulations Physico Chemical Methods of Analysis

UNIT - II

SEPARATION TECHNIQUES

10h

- 1. Solvent extraction: Principle and process, Batch extraction, continuous extraction and counter current extraction. Application – Determination of Iron (III)
- 2. Chromatography: Classification of chromatography methods, principles of differential migration adsorption phenomenon, Nature of adsorbents, solvent systems, Rf values, factors affecting Rf values.
 - a) Paper Chromatography: Principles, Rf values, experimental procedures, choice of paper and solvent systems, developments of chromatogram –ascending, descending and radial. Two dimensional chromatography, applications.
 - b) Thin layer Chromatography (TLC): Advantages. Principles, factors affecting Rf values. Experimental procedures. Adsorbents and solvents. Preparation of plates. Development of the chromatogram. Detection of the spots. Applications.
 - c) Column Chromatography: Principles, experimental procedures, Stationary and mobile Phases, Separation technique. Applications.
 - d). High Performance Liquid Chromatography (HPLC): Principles and Applications.
 - e). Gas Liquid Chromatography (GLC): Principles and Applications.

Catalysis:

4h

Homogeneous and heterogeneous catalysis, comparison with examples. Kinetics of specific acid catalyzed reactions, inversion of cane sugar. Kinetics of specific base catalyzed reactions, base catalyzed conversion of acetone to diacetone alcohol. Acid and base catalyzed reactions- hydrolysis of esters, mutarotation of glucose. Catalytic activity at surfaces. Mechanisms of heterogeneous catalysis. Langmuir-Hinshelwood mechanism. Enzyme catalysis: Characteristics and classification. Kinetics of enzyme catalyzed reactions- Michelis Menton Law.

Materials science:

4h

Nanomaterials- synthetic techniques, bottom-up-sol-gel method, top-down electrodeposition method. Properties and applications of nano-materials. Composites-definition, general characteristics, particle reinforce and fiber reinforce composites and their applications.

PAPER IV

Elective – II

Analytical and Physical

PAPER – VIII-A-1: POLYMER CHEMISTRY

30 hrs (3 h / w)

UNIT-II

10h

Techniques of Polymerization : Bulk polymerization , solution polymerization , suspension and Emulsion polymerization.

Molecular weights of polymers: Number average and weight average molecular weights
Determination of molecular weight of polymers by Viscometry , Osmometry and light scattering methods.

UNIT-III

6h

Kinetics of Free radical polymerization, Glass Transition temperature(Tg) and Determination of Tg:

Free volume theory, WLF equation, factors affecting glass transition temperature (Tg).

UNIT-IV

9h

Polymer additives:

Introduction to plastic additives – fillers, Plasticizers and Softeners , Lubricants and Flow Promoters, Anti aging additives , Flame Retardants , Colourants , Blowing agents , Cross linking agents ,Photo stabilizers , Nucleating agents.

UNIT-V

5h

Polymers and their applications:

Preparation and industrial applications of Polyethylene, Polyvinyl chloride, Teflon, Polyacrylonitrile, Terelene , Nylon6.6 silicones.

Reference Books:

1. Seymour, R.B. & Carraher, C.E. *Polymer Chemistry: An Introduction*, Marcel Dekker, Inc. New York, 1981.
2. Odian, G. *Principles of Polymerization*, 4th Ed. Wiley, 2004.
3. Billmeyer, F.W. *Textbook of Polymer Science*, 2nd Ed. Wiley Interscience, 1971.
4. Ghosh, P. *Polymer Science & Technology*, Tata McGraw-Hill Education, 1991.34
5. Lenz, R.W. *Organic Chemistry of Synthetic High Polymers*. Interscience Publishers, NewYork, 1967.

LABORATORY COURSE – VII

Practical Paper – VII (at the end of semester VI) 30 hrs (2 h / W)

1. Preparation of Aspirin
2. Preparation of Paracetamol
3. Preparation of Acetanilide
4. Preparation of Barbituric Acid
5. Preparation of Phenyl Azo β -naphthol

LABORATORY COURSE – VIII

Practical Paper – VII-(A) (at the end of semester VI) 30hrs (2 h / W) 50M

1. Identification of aminoacids by paper chromatography.
2. Colorimetry- Determination of KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$
3. Determination of Zn using EDTA
4. Determination of Mg using EDTA