VIVEKANANDHA

COLLEGE OF ARTS AND SCIENCES FOR WOMEN [AUTONOMOUS]

An ISO 9001:2008 Certified Institution,
Affiliated to Periyar University, Salem,
(Approved by AICTE and Re-Accredited with 'A' Grade by NAAC,
Recognized Under 2(f) and 12(b) of UGC Act, 1956).
Elayampalayam, Tiruchengode - 637 205, Namakkal Dt., Tamilnadu, INDIA.

DEPARTMENT OF CHEMISTRY
BACHELOR OF SCIENCE (B.Sc.)

VICAS

CHEMISTRY

B.Sc., CHEMISTRY
REGULATIONS AND SYLLABUS

[FOR CANDIDATES ADMITTED FROM 2017-18 ONWARDS UNDER AUTONOMOUS - CBCS PATTERN]

VIVEKANANDHA EDUCATIONAL INSTITUTIONS FOR WOMEN * 1992 * WOMEN EMPOWERMENT

SPONSORED BY
ANGAMMAL EDUCATIONAL TRUST

Elayampalayam – 637 205, Tiruchengode Tk., Namakkal Dt., Tamil Nadu.
Veerachipalayam - 637 303, Sankari Tk., Salem Dt., Tamil Nadu.
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About the College

Vivekanandha College of Arts and Sciences for Women (Autonomous) was established and hailed into Women's Educational Service in the Year 1995. Angammal Educational Trust Chaired by the great Educationalist 'Vidhya Rathna' Prof. Dr. M. KARUNANITHI, B.Pharm., M.S., Ph.D., D.Litt., sponsors this college and other institutions under the name of the great Saint Vivekanandha. Our institutions are situated on either side of Tiruchengode-Namakkal Main Road at Elayampalayam, 6 kms away from Tiruchengode. This is biggest women's college in India with more than 7500 girl students and more than 18 departments. The strength of the college was just 65 at the time of its establishment. With the dedication, work, sacrifice and long vision of the chairman, this institution has grown into a Himalaya stage. As a result of which UGC, New Delhi, awarded 2f and 12b, extended Autonomous status for second cycle. The National Assessment and Accreditation Council reaccredited with grade 'A' for its successful performance.

As an Autonomous Institution, academic professionals of the college framed Curriculum and Syllabi in consultation with all its stakeholders to cater the needs of the young women to fulfill the women empowerment and present Industrial needs to the local benefits. The students are empowering with confidence and required skills to face the society.

Quality Policy

To provide professional training by establishing a high level center of learning that provides quality education at par with the international standards and Provide excellence education with well equipped infrastructure to all the rural women.

Our Vision

To be an academic institution exclusively for women, in dynamic equilibrium with the social and economic environment, strive continuously for excellence in education, research and technological service to the nation.

Our Mission

The mission of our institution is to discover, teach and apply knowledge for the intellectual, cultural, ethical, social and economic growth of women students.

7	Core Practical III – Physical Chemistry	
8	Core Practical IV – Organic Analysis & Preparations , Gravimetric Estimations	

REGULATIONS

I SCOPE OF THE COURSE

The uniqueness of the B.Sc. (Chemistry) program is its content and topic coverage, the teaching methodology and the faculty. The program expects a serious commitment of the students to take up challenging study schedules and assignments. The course involves a blend of theoretical education and practical training which run concurrently for a period of three years and equips a student with knowledge, ability, skills and other qualities.

The teaching methodologies include classroom lectures, industrial visits, orientation and internship. The new syllabus may help the students to understand the newer aspects of chemistry and apply the same to the real life situations. Thus the students turn more relevant and resourceful to the society. It may enable the young minds think differently and forms a link between old ideas and new ideas in chemistry and gives comprehensive approaches to the very learning process and the learners.

II. SALIENT FEATURES

- ✓ Course is specially designed for a higher level career placement.
- ✓ Special guest lectures from industrialists will be arranged.
- ✓ Exclusively caters to students interested in pursuing higher studies.
- ✓ Special industry orientations and training are parts of the degree course.

III. OBJECTIVES

The new syllabus throws light on the recent and emerging areas of

chemistry.

- ✓ Enable the students to understand chemistry and make them more relevant to the society.
- ✓ Develop the analytical ability in students so that they themselves prepared in solving problems.
- ✓ Help the students to learn practical skills in a better way.
- ✓ Inculcate research aptitude among the students.
- ✓ Enable the students to go to higher levels of learning chemistry.
- ✓ Improve the employability of the students.
- ✓ Inspire the students to apply their knowledge gained for the development of society in general and individuals in particular.

IV. ELIGIBILITY FOR ADMISSION

A candidate who has passed Higher secondary examination of Tamil nadu Higher secondary board or an examination of some other board accepted by the syndicate as equivalent there to with Chemistry and Physics and any one of the subjects namely Maths, Botany, Zoology or Biology, Home science shall be eligible for admission into B.Sc., course in chemistry.

V. DURATION OF THE COURSE

- ➢ The course shall extend over a period of three academic years consisting of six semesters. Each academic year will be divided into two semesters. The first semester will consist of the period from July to November and the second semester from December to April.
- ➢ The subjects of the study shall be in accordance with the syllabus prescribed from time to time by the Board of Studies of Vivekanandha College of Arts and Sciences for Women (Autonomous), Tiruchengode with the approval of Periyar University, Salem.
- ➢ Each subject will have required hours of lecture per week apart from

practical training.

VI ASSESSMENT

Assessment of the students would be made through Continuous Internal Assessment (CIA) and External Assessment (EA) for passing each subject both theory and practical papers.

A candidate would be permitted to appear for the External Examination only on earning 75 % of attendance and only when her conduct has been satisfactory. It shall be open to grant exemption to a candidate for valid reasons subject to conditions prescribed.

A. CONTINUOUS INTERNAL ASSESSMENT (CIA)

The performance of the students will be assessed continuously by the teacher concern and the Internal Assessment Marks will be as follows:

Distribution Of Continuous Assesment Marks (Theory-25/Practical-40)

Activity (Theory)	Period (WD)	Marks (25)	Activity (Practicals)	Marks (40)
Attendance	90	5	Attendance	5
CA Test I	30 to 35	2.5	Review I	5
CA Test II	60 to 65	2.5	Review II	5
Model	After 90	10	Model Practical Examination	10
Assignment	15 to 20	1	Observation note	10
Poster	30 to 35	1	Results in lab/Work	5
PowerPoint	45 to 50	1		
Skit	60 to 65	1		
Group discussion	65 to 70	1		
Total		**25**		**40**

Distribution of attendance mark

S. No.	Percentage	Marks	
		Theory	Practical
1	76-80	1	2
2	81-85	2	4
3	86-90	3	6
4	91-95	4	8
5	96-100	5	10

B. EXTERNAL ASSESSMENT (EA)

The performance of the students would be assessed by examination at the end of each semester with a written test for theory for three hours and practical examination at the end of even semesters for six hours. Question papers would be set by the selected external examiners in the prescribed format and valuated by the external examiners with the help of the teacher concern.

The pattern of assessment is as follows:

Distribution Of Final Assesment Marks (75/60)

Section	Activity	Marks (75)	Activity	Marks (60)
A	One mark (20)	20	Record work	5
B	Five marks (Either or)	25	Viva Voce	5
C	Ten marks (3/5)	30	Spotter	20
			Major (Performance)	5
			Major (Result)	5
			Major (Writeup)	10
			Minor (Performance)	2
			Minor (Result)	3
			Minor (Writeup)	5
Total		**75**	**Total**	**60**

VII. PASSING MINIMUM

INTERNAL

There is no passing minimum for CIA

EXTERNAL

In the End Semester Examinations, the passing minimum shall be 30 out of 75 Marks for theory (40 %) and 24 out of 60 marks for practical (40 %).

VIII. CLASSIFICATION OF SUCCESSFUL CANDIDATES

1. Successful candidates passing the examination of core and allied papers and securing
   - **a)** 75 % and above shall be declared to have passed the examination in first class with distinction provided they pass all the examinations prescribed for the course at first appearance itself.
   - **b)** 60% and above shall be declared to have passed the examinations in first class.
   - **c)** 50% and above but below 60% shall be declared to have passed the examinations in second class.
2. All the remaining successful candidates shall be declared to have passed the examinations in third class.
3. Candidates who pass all the examinations prescribed for the course at the first appearance itself and within a period of three consecutive academic years from the year of admission only will be eligible for ranking purpose.

IX. ELIGIBILITY FOR AWARD OF THE DEGREE

A candidate shall be eligible for the award of the degree only if she has undergone the above degree for a period of not less than three academic years comprising of six semesters and passed the examinations prescribed and fulfiled the conditions prescribed.

X. PROCEDURE IN THE EVENT OF FAILURE

If a candidate fails in a particular subject, she may reappear for the End Semester Examination in the concerned subject in subsequent semesters and shall pass the examination.

XI. COMMENCEMENT OF THESE REGULATIONS

These regulations shall take effect from the academic year 2017-18.

XII. COURSE PATTERN

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)
SYLLABUS FRAME WORK

Subjects & Paper Code	Inst. Hour/Week	Credit	Exam Hours	Internal	External	Total Marks	Subjects	Inst. Hour/Week	Credit	Exam Hours	Internal	External	Total Marks
YEAR I													
Semester I							**Semester II**						
Language I & 17U1LT01	4	3	3	25	75	100	Language II & 17U2LT02	4	3	3	25	75	100
English I & 17U1LE01B	4	3	3	25	75	100	English II & 17U2LE02B	4	3	3	25	75	100
Core I & 17U1CHC01	5	5	3	25	75	100	Core II & 17U2CHC02	4	5	3	25	75	100
Core I Practical & 17U2CHCP01	4	0	0	0	0	0	Core I Practical & 17U2CHCP01	4	4	3	40	60	100
Allied I & 17U1PHA01	5	5	3	25	75	100	Allied II & 17U2PHA02	4	5	3	25	75	100
Allied I Practical & 17U2PHAP01	4	0	0	0	0	0	Allied I Practical & 17U2PHAP01	4	4	3	40	60	100
Valued added course & 17U1VE01	2	2	3	25	75	100	Valued added course &17U2ES01	4	4	3	25	75	100
Library	1	0	0	0	0	0	Library	1	0	0	0	0	0
Sports	1	0	0	0	0	0	Sports	1	0	0	0	0	0
Total	**30**	**18**	**15**	**125**	**375**	**500**	**Total**	**30**	**28**	**21**	**205**	**495**	**700**
I YEAR TOTAL									**46**	**38**	**410**	**990**	**1200**
YEAR II													
Semester III							**Semester IV**						
Language III & 17U3LT03	4	3	3	25	75	100	Language IV & 17U4LT04	4	3	3	25	75	100
English III & 17U3LE03B	4	3	3	25	75	100	English IV & 17U4LE04B	4	3	3	25	75	100
Core III & 17U3CHC03	5	5	3	25	75	100	Core IV & 17U4CHC04	5	5	3	25	75	100
Core II Practical & 17U4CHCP02	4	0	0	0	0	0	Core II Practical & 17U4CHCP02	4	4	3	40	60	100
Allied III & 17U3MAA01	5	5	3	25	75	100	Allied IV & 17U3MAA02	5	5	3	25	75	100
Allied II Practical & 17U4MAAP01	4	0	0	0	0	0	Allied II Practical & 17U4MAAP01	4	4	3	40	60	100
NMEC I & 17U3PHN01	2	2	3	25	75	100	NMEC II & 17U4PHN02	2	2	3	25	75	100
Library	1	0	0	0	0	0	Library	1	0	0	0	0	0
Sports	1	0	0	0	0	0	Sports	1	0	0	0	0	0
Total	**30**	**18**	**15**	**125**	**375**	**500**	**Total**	**30**	**26**	**21**	**205**	**495**	**700**

II YEAR TOTAL								**90**	**72**	**660**	**1740**	**2400**
YEAR III													
Semester V							**Semester VI**						
Core V & 17U5CHC05	5	5	3	25	75	100	Core VIII & 17U6CHC08	5	5	3	25	75	100
Core VI & 17U5CHC06	5	5	3	25	75	100	Core IX & 17U6CHC09	5	5	3	25	75	100
Core III Practical & 17U6CHCP03	3	0	0	0	0	0	Core III Practical & 17U6CHCP03	3	4	3	40	60	100
Core IV Practical & 17U6CHCP04	5	0	0	0	0	0	Core IV Practical & 17U6CHCP04	5	5	3	40	60	100
Core VII & 17U5CHC07	5	5	3	25	75	100	Core X & 17U6CHC10	5	5	3	25	75	100
SBEC I & 17U5CHS01	3	2	3	25	75	100	Elective I & 17U6CHE01	4	4	3	25	75	100
SBEC II & 17U5CHS02	3	2	3	25	75	100	SBEC III & 17U6CHS03	3	2	3	25	75	100
Library/Sports	1	0	0	0	0	0	Library/Sports	1	0	0	0	0	0
							Extension work	0	1	0	0	0	100
Total	**30**	**19**	**21**	**125**	**375**	**500**	**Total**	**30**	**31**	**21**	**205**	**495**	**700**
TOTAL CREDIT FOR THE COURSE								**140**	**126**	**1230**	**2970**	**3600**

Distribution Of Duration And Credit Under Different Papers

Part	Paper	Hours/Week	Weeks/Semester	Hour/Paper	No. of Papers	Credit/Paper	Total Hours	Total credit
I	**Language**	4	15	60	4	3	240	12
II	**English**	4	15	60	4	3	240	12
III	**Core paper**	5	15	75	10	5	600	50
III	**Core practical**	4	15	75	4	4/5	600	17
III	**Allied**	5	15	60	4	5	240	20
III	**Allied practical**	4	15	60	2	4	240	8
IV	**Value Education**	6	15	15	2	3	30	6
IV	**SBEC**	4	15	30	2	2	120	4
III	**Elective**	4	15	60	2	3	120	6
IV	**NMEC**	2	15	30	2	2	60	4
IV	**Extension work**	1	15	15	1	1	15	1
TOTAL								**140**

CORE PAPER – V

ORGANIC CHEMISTRY

SUBJECT CODE: 17U5CHC05		
SEMESTER – V	**CREDIT : 5**	**HOURS : 60**

OBJECTIVES

1. To gain knowledge about optical and geometrical isomerism.
2. Acquire the knowledge about heterocycles.
3. To understand the reaction mechanism and reagents in organic synthesis.

Learning Outcome

Student will be able to get an insight into basic concept of optical isomerism .

Students will have a firm foundation in the fundamentals of heterocyclic chemistry, methods of synthesis and application of those methods for the preparation of specific groups of heterocyclic systems.

Students will be skilled in solving the problems related to isomerisms.

Students will have a clear understanding of mechanisms in organic reactions.

Students will be skilled enough to choose a reagent to carry out organic reactions.

UNIT I Optical isomerism (12 Hours)

Isomerism-Introduction, Types. Optical isomerism-Definition, Specific rotation-conditions for optical activity-asymmetric centre-Chirality- achiral molecules-meaning of (+) and (-) and d and l notations- Elements of symmetry. Projection formulae-Fischer, and Newmann projection formulae-Notation of optical isomers- Cahn- Ingold –Prelog rule, R-S notations for optical isomers with one and two asymmetric Carbon atoms-erythro and threo representations. Resolution methods (mechanical, seeding, biochemical and conversion to diastereoisomers).

UNIT II Geometrical isomerism and Conformational analysis (12 Hours)

Geometrical isomerism- Definition, cis-trans, syn-anti and E-Z notations-geometrical isomerism in maleic and fumaric acids and unsymmetrical ketoximes. Methods of distinguishing geometrical isomers using melting point, dipole moment, dehydration, cyclisation and heat of hydrogenation. Conformational Analysis-introduction of terms-conformers, dihedral angle, torsional strain, conformational analysis of ethane, ethylene

glycol, ethylene chlorohydrin and n-butane including energy diagrams-conformers of cyclohexane (chair, boat and skew boat forms)-axial and equatorial bonds-ring flipping showing axial equatorial interconversions.

UNIT III Molecular rearrangements and Reactions (12 Hours)

Benzil-Benzilic acid, Cope, Fries rearrangements, Friedel craft, Reformatsky, Perkin reactions. Robinson annulations, Kolbe electrolysis, Aldol, Claisen condensation

UNIT IV Heterocyclic compounds (12 Hours)

General classification - preparation, properties and uses of pyrrole, furan, thiophene and pyridine. Preparation, properties and uses of condensed five and six membered heterocyclics - indole, benzofuran, quinoline and isoquinoline.

UNIT V Reagents in organic synthesis (12 Hours)

Na/ethanol, alcoholic KOH, H_2/Ni, H_2/Pd-$BaSO_4$, Zn/Hg-HCl, H_2N-NH_2/C_2H_5ONa, Ag_2O, HIO_4, Baeyers, Grignard reagent, manganese dioxide, n-butyl lithium.

CONTENTS BEYOND THE SYLLABUS

1. Methods of identification of optical isomers, resolution, methods of resolution
2. Comparative study of basicity of pyrrole, pyridine with amines.
3. Conformation and stereochemistry of alkane
4. Rearrangement like Wagner-Meerwein, Wolf, Beckmann
5. Important reagents in organic synthesis $AlCl_3$, BF_3, $LiAlH_4$, $NaBH_4$, PCl_5

TEXT BOOKS

1. Finar I.L, Organic chemistry Vol I sixth edition, ELBS, Pearson Education Ltd.,2004
2. Finar I.L, Organic chemistry Vol II fifth edition, ELBS, Pearson Education Ltd.,2012
3. O.P.Agarwal, Reactions and Reagents, Krishna prakashan media (p) Ltd., 1975
4. Y.R.Sharma, Elementary Organic Absorption Spectroscopy – principles and chemical applications, S.Chand and Co., 2006.
5. Kalsi.P.S, Stereochemistry, Conformation and Mechanism, New Age International (p) Ltd, VIIth, 2008.
6. Nasipuri. D, Stereochemistry of organic compounds, second edition, Wiley Eastern Ltd., 1994.
7. Bhal B.S and Arun Bhal- a text book of organic chemistry, S.Chand & company ltd, 1948.

8. V.K.Ahluwalia, Rakesh kumar, Parashar.R.K, Organic reaction and mechanism, IVth edition, Narosa publishing house pvt Ltd., 2011.

REFERENCES

1. K.S.Tewari, and N.K.Vishoni, Organic Chemistry, Vikas Publishing House.
2. Soni.P.L and Chawla.H.M. Text book of organic chemistry, 26th revised edition, Sultan chand and sons, 1995.
3. R.T.Morrison and Boyd, Organic Chemistry, VIth edition, PHI Learning Pvt Ltd., 2008.

ONLINE SOURCES:

1. https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Supplemental_Modules_(Organic_Chemistry)/Fundamentals/Isomerism_in_Organic_Compounds/Optical_Isomerism_in_Organic_Molecules
2. https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Supplemental_Modules_(Organic_Chemistry)/Fundamentals/Isomerism_in_Organic_Compounds/Geometric_Isomerism_in_Organic_Molecules
3. http://www.3rd1000.com/chem301/chem302a.htm
4. https://www.scribd.com/doc/97295442/Molecular-Rearrangements
5. https://www.wiley.com/en-us/Molecular+Rearrangements+in+Organic+Synthesis-p-9781118347966
6. https://www.thoughtco.com/definition-of-reagent-and-examples-605598

CORE PAPER – VI

INORGANIC CHEMISTRY-I

SUBJECT CODE: 17U5CHC06		
SEMESTER – V	**CREDIT : 5**	**HOURS : 60**

OBJECTIVES

1. To help the student to understand the basic concepts in inorganic chemistry and to develop their critical thinking.
2. To learn the basics and applications of the inorganic compounds.

Learning Outcome

Students will master the basics in inorganic chemistry of acids & bases, solvents and coordination complexes.

Students will have basic understanding on the chemistry of inorganic complexes.

Students will be able to interpret the applications of inorganic compounds in day to day life.

UNIT-I: Modern Concepts of Acids and Bases (12 HOURS)

Acids and Bases – Arrhenius concept – Bronsted - Lowry concept - Luxflood concept - Lewis concepts of acids and bases - Usanovich concept - Conjugate acid - base pairs – Relative strength of acids and bases: Hydracids & Oxyacids – Levelling & Differentiating solvents - Solvent system concept.

Hard and Soft Acids and Bases - Classification of acids and bases as hard and soft – examples - Pearson's HSAB Principle and its applications.

UNIT – II: Non-Aqueous Solvents (12 HOURS)

Classification of solvents – General Characteristics of a solvent, Reaction in non aqueous solvents with reference to liq NH_3, Solutions of alkali metals in ammonia, liq SO_2, liq. N_2O_4, anhydrous H_2SO_4, liq.HF, and molten salts.

UNIT-III: Chemistry of f-Block Elements (12 HOURS)

Position in the periodic table - general characteristics of Lanthanides and Actinides- Lanthanide contraction and its consequences - Isolation of Lanthanides from monazite including the Ion exchange resin methods – Actinides - occurrence and preparation -

Chemistry of thorium and uranium – important compounds – preparation, properties and uses of Uranyl nitrate, Uranium hexa fluoride, Thorium dioxide and Thorium nitrate - Comparison of Lanthanides and Actinides.

UNIT-IV: Coordination Chemistry-I (12 HOURS)

Definition and classification of ligands - Nomenclature of mononuclear and poly nuclear complexes - chelating ligands – chelate effect - coordination number and stereochemistry of complexes - Isomerism in complexes - structural isomerism - stereo isomerism – geometrical isomerism and optical isomerism in 4 and 6 coordinated complexes - Werner's theory & its evidences - Sidgwick theory – EAN rule and its applications.

UNIT-V: Coordination Chemistry-II (12 HOURS)

Theories of bonding in complexes: VB theory – postulates - Hybridization and Geometry of complexes - Outer orbital and inner orbital octahedral complexes - Square planar - tetrahedral complexes - Magnetic properties of complexes - limitations of VB theory.

Crystal Field Theory – postulates - d orbital splitting in octahedral, tetrahedral and square planar complexes - strong and weak field ligands - Spectro chemical series - High spin and Low spin complexes – Colour and Magnetic properties of complexes - CFSE and its uses - Limitations of CFT-Comparison between VBT and CFT.

CONTENT BEYOND THE SYLLABUS

1. Students will be able to prepare simple coordination complexes in lab.
2. Students can analyze and check the properties of acids and bases in lab.
3. Students will be able to understand the chemistry of many coordination complexes and their use as drugs.

TEXT BOOKS

1. Puri, Sharma, Kalia, Principles of Inorganic Chemistry 32nd Edition (2014), Milestone Publishers and Distributor, New Delhi.
2. Wahid. U. Malik, G. D. Tuli, R. D. Madan, Selected topics in Inorganic Chemistry, S.Chand & company, New Delhi.

3. R. D. Madan, Satyaprakash's Modern Inorganic Chemistry (1987), S. Chand Publishing,
New Delhi.

REFERENCE BOOKS

1. Satya Prakash, G.D. Tuli, S.K. Basu and R.D. Madan, Advanced Inorganic Chemistry – Vol – I (2006), S. Chand Publishing, New Delhi.
2. Satya Prakash, G.D. Tuli, S.K. Basu and R.D. Madan, Advanced Inorganic Chemistry – Vol – II (2006), S. Chand Publishing, New Delhi.

ONLINE SOURCES

1. https://en.wikibooks.org/wiki/Introduction_to_Inorganic_Chemistry
2. https://en.wikipedia.org/wiki/Inorganic_chemistry
3. https://www.chemguide.co.uk/inorgmenu.html

CORE PAPER-VII

PHYSICAL CHEMISTRY - I

SUBJECT CODE: 17U5CHC07		
SEMESTER – V	**CREDIT : 5**	**HOURS : 60**

OBJECTIVES

Facilitate the students to study about the nature of solutions, kinetics of reactions and learn the concepts of chemical equilibrium.

Learning Outcome

Students will learn the laws of solutions and deviations of solution w.r.t. pressure, temperature and volume.

Students can understand fundamental concepts of chemical equilibrium.

Students will have enhanced knowledge towards advanced conception of chemical equilibrium.

Students will able to understand and explain the theories of chemical kinetics.

Students will be skilled in solving the problems of Kinetics.

UNIT – I: Solutions (12 HOURS)

Solutions of gases in liquids - Henry's law - solutions of liquids in liquids - Raoult's law. Ideal solution - Binary liquid mixture - deviation from ideal behavior -Thermodynamics of ideal solutions - V-P-composition curves, V-P-temperature curves – Azeotropic distillation. Nernst's distribution law- Colligative properties-Introduction, Thermodynamic derivations, applications and limitations. Thermodynamic derivation of elevation of boiling point and depression of freezing point- Van't Hoff factor- Abnormal molecular mass.

UNIT – II: Chemical Equilibrium- I (12 HOURS)

Reversible reactions - nature of chemical equilibrium - definition, characteristics of chemical equilibrium - Law of mass action. Equilibrium Law - Derivation - equilibrium constant expression in terms of general and concentration, partial pressure and mole fraction- Heterogeneous equilibrium - Related problems. Thermodynamic derivation of law of chemical equilibrium (K_p, K_c and K_x)- Relations between K_p, K_c and K_x - Problems related to K_p and K_c.

UNIT- III: Chemical Equilibrium- II (12 HOURS)

Equilibrium law for ideal gases – Effect of inert gas on reaction equilibrium. Le Chatelier's principle – effect of change in concentration, pressure and temperature. Derivation of van't Hoff reaction isotherm. de-Donder's treatment of chemical equilibria - concept of chemical affinities. Temperature dependence of equilibrium constant - van't Hoff Isochore - Pressure dependence of equilibrium constant.

UNIT – IV: Chemical Kinetics-I (12 HOURS)

Chemical kinetics and its scope - rate of a reaction, factors influencing the rate of the reaction. Order and molecularity of a reaction: Definition, types – difference between order and molecularity - Derivation of rate constant and half life period for zero, first order reactions - Derivation of rate constant for second order (same and different initial concentrations) and third order reactions (same initial concentrations only). Methods to determine the order of the reaction – Isolation and half life methods. Kinetics of complex reactions. Parallel and consecutive reactions only.

UNIT – V: Chemical Kinetics-II (12 HOURS)

Theories of chemical kinetics: Arrhenius equation, effect of temperature on rate of reaction, concept of activation energy. Collision theory of reaction rates- introduction, Derivation of rate constant for bimolecular reaction from collision theory, Failures of CT. Lindemann theory - Introduction, Derivation of rate constant for unimolecular reaction. Theory of absolute reaction rates- Introduction, Thermodynamic derivation of rate constant for bimolecular reaction based on ARRT.

CONTENT BEYOND THE SYLLABUS

1. Real solutions and colligative properties.
2. Homogeneous equilibrium and dissociation of PCl_5 and N_2O_4.
3. Biochemical equilibria.
4. Mechanism of complex reactions.
5. Problems related to first, second and third order reactions.

TEXT BOOKS

1. Arun Bahl, B.S. Bahl and G.D. Tuli, Essentials of Physical Chemistry, Revised multicolor edition, S. Chand publication Ltd, New Delhi, 2010.
2. Puri B.R., Sharma L.R., Pathania M.S., Principles of Physical Chemistry, (47th edition) Vishal Publishing Co., New Delhi, 2017.
3. Kundu N. and Jain S.K., Physical Chemistry, S. Chand & Company Ltd, New Delhi, 1990.

REFERENCE BOOKS

1. Peter Atkins and Julio de Paula, Physical Chemistry, 7th Edn, Oxford University Press, New York, 2002.
2. Rajaram J. and Kuriacose J.C., Kinetics and mechanisms of chemical transformations, First edition, Macmillan Publishers India Ltd, New Delhi, 2011.
3. Rastogi R.P. and Misra R.R., An introduction to chemical thermodynamics, 6th revised edition, Vikas Publishing House Pvt. Ltd, New Delhi, 2005.

ONLINE SOURCES

1. https://www.britannica.com/science
2. https://www.chemqueries.com
3. https://socratic.org/Chemistry
4. https://chem.libretexts.org
5. https://www.askiitians.com/Physical Chemistry/Chemical Kinetics

ELECTIVE COURSE – I

ANALYTICAL CHEMISTRY

SUBJECT CODE: 17U5CHE01		
SEMESTER – V	**CREDIT : 3**	**HOURS : 60**

OBJECTIVES

1. To help the student to develop the habit of accurate manipulation and an attitude of critical thinking.
2. To learn the basic analytical methods and appreciate what is involved in an analysis.

Learning Outcome

Students will utilize the learned analytical skills in handling various chemical and biochemical instruments.

Students will have basic understanding on purification and separation techniques.

Students will have a thorough understanding of thermal and electro analytical techniques.

Students will be able to interpret the results of quantitative experiments and interpret the data in meaningful way.

UNIT-I: Laboratory Hygiene and safety (12 HOURS)

Storage and handling of corrosive, flammable, explosive, toxic, carcinogenic and poisonous chemicals. Simple first aid procedures for accidents involving acids, alkalies, bromine, burns and cut by glass. Threshold vapour concentration - safe limits. Waste disposal**.** Heating methods, stirring methods, filtration techniques. Calibration of pipette, standard measuring flask and burette.

UNIT-II: Gravimetric Analysis (12 HOURS)

Principle-theories of precipitation-solubility product and precipitation-factors affecting solubility product- precipitational errors- Co-precipitation and post-precipitation, Reduction of errors. Precipitation from homogeneous solution, washing and drying of precipitate. Calculation in gravimetric analysis - use of gravimetric factor. Choice of precipitant-specific and selective precipitant- Anthranilic acid, cupferon, DMG, ethylenediamine, 8-hydroxyquinoline, salicylaldoxime, use of masking and demasking agent. Crucibles-types, care and uses.

UNIT-III: Purification Techniques (12 HOURS)

Dessicant: Types of dessicant: Relative efficiencies of dessicant, Drying power and temperature, Regeneration of dessicant, choice of dessicants - Technique of drying: Drying of solids. Purification of solid organic compounds - Recrystallisation, Extraction, sublimation, use of miscible solvents, use of drying agents and their properties. Purification of liquids- Distillation: Theory of distillations; Technique; Fractional distillation, Steam distillation, Azeotropic and Vaccum distillation.

UNIT-IV: Chromatographic Techniques (12 HOURS)

Introduction - Adsorption Chromatography-Partition Chromatography. Column Chromatography - principle, types of adsorbents, preparation of the column, elution, recovery of substances and applications. TLC –Principle, Choice of adsorbent and solvent, preparation of chromatoplates, R_f-value, factors affecting the R_f values. Significance of R_f value. Paper chromatography - principle, solvents used, paper electrophoresis - separation of amino acids. Gas Chromatography (GC)-principle - instrumentation and applications of Gas Chromatography (GC) and High pressure liquid chromatography (HPLC). High pressure liquid chromatography (HPLC)-principle - instrumentation and advantages.

UNIT-V: Thermal and electroanalytical techniques (12 HOURS)

Principle - Thermogravimetric analysis and Differential Thermal Analysis - discussion of various components with block diagram- TGA & DTA curves of $CuSO_4.5H_20$ and $CaC_2O_4.H_2O$ in air and in CO_2- factors affecting TGA & DTA curves.

Polarography- principle, concentration polarization, dropping mercury electrode (DME)- advantages and disadvantages- migration, residual, limiting and diffusion currents- Use of supporting electrolytes- Ilkovic equation (derivation not required) and significance-current voltage curve- oxygen wave. Half wave potential ($E_{1/2}$)- Polarography as an analytical tool in quantitative and qualitative analysis.

CONTENT BEYOND SYLLABUS

1. Calculation of solubility product.
2. Selection of desiccant for the purification of solids, liquids.
3. Comparison between adsorption, partition and column chromatography.

TEXT BOOKS

1. D.A. Skoog, D.M. West and F.J. Holler, Analytical Chemistry: An Introduction, 5th edition, Saunders college publishing, Philadelphia, 1990.
2. U.N. Dash, Analytical Chemistry: Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 1995.
3. R.A. Day Jr. A.L. Underwood, Quantitatives Analysis, 5th edition, Prentice Hall of India Private Ltd., New Delhi, 1988.
4. R. Gopalan, Analytical Chemistry, S. Chand and Co., New Delhi

REFERENCE BOOKS

1. Elementary Organic Spectroscopy: Principles and Chemical Applications, S.Chand and company Ltd., Ram Nagar, New Delhi, 1990.
2. V.K. Srivastava, K.K. Srivastava, Introduction to Chromatography: Theory and Practice, S. Chand and company, New Delhi, 1987.
3. R.M. Roberts, J.C. Gilbert, L.B. Rodewald, A.S. Wingrove, Modern Experimental Organic Chemistry, 4th edition, Holt Saunders international editions.
4. A.K. Srivastava, P.C. Jain, Chemical Analysis: An Instrumental Approach for B.Sc. Hons. and M.Sc. Classes, S. Chand and company Ltd., Ram Nagar, New Delhi.

ONLINE SOURCES

1. https://www.news-medical.net/life-sciences/Analytical-Chemistry-Techniques.aspx.
2. https://www.toppr.com/guides/chemistry/organic-chemistry/purification-of-organic-compounds
3. https://www.hitachihightech.com/global/products/science/tech/ana/thermal/descriptions/ta.html

SKILL BASED ELECTIVE COURSE – I

SPECTROSCOPY

SUBJECT CODE: 17U5CHS01		
SEMESTER – V	**CREDIT : 2**	**HOURS : 60**

OBJECTIVES

Students acquire the knowledge about the fundamentals and different types of spectroscopy .

Learning Outcome

Students know principle, instrumentation and applications of Rotational spectroscopy.

Students can able to learn theory, laws, types of band and applications of IR Spectroscopy.

Knowledge of students will be developed in the field of Raman spectroscopy by the learning of Scattering, stokes and anti stokes line etc.

To understand the concept of NMR spectrum and its applications.

Students have an idea of different types of peak, Nitrogen rule and fragmentation of Mass spectroscopy.

UNIT – I Rotational Spectroscopy (12 HOURS)

Fundamental concepts electromagnetic spectrum – Region of spectrum, Interaction of radiation with matter. Rotational Spectroscopy - Principle-Instrumentation-Selection rules for rotational spectroscopy - Molecular rotation-diatomic molecule as rigid rotor-diatomic molecule as non-rigid rotor. Applications of rotation spectra: bond length-isotopic substitution.

UNIT – II IR & Raman Spectroscopy (12 HOURS)

Theory-Instrumentation- Hooke's Law – bands in IR spectrum - Units- Number and types of fundamental vibrations-Modes of vibrations and their energies- Factor affecting the frequency of absorption-Conjugation, inductive effect and hydrogen bonding. Applications of IR –Identification of Functional groups.

Rayleigh scattering and Raman scattering - Stokes and anti-stokes lines in Raman spectra - Raman frequency - condition for a molecule to be Raman active - Comparison of Raman and IR spectra.

UNIT – III NMR spectroscopy (12HOURS)

Nuclear spin and conditions for a molecule to give rise to NMR spectrum- Theory of NMR spectra-Instrumentation- chemical shift, Number of NMR signals - shielding, de-shielding, Factors influencing chemical shift.TMS & its applications, peak area and number of protons –splitting of signals-spin-spin coupling.

UNIT – IV UV-VIS spectroscopy (12 HOURS)

Theory-Instrumentation-Beer-Lamberts Law – bands in UV-VIS spectrum – possible electronic transitions – types of electronic transitions based on selection rules – characteristic absorption (λ_{max} and ε_{max}) of carbonyl , isolated double bond, conjugated double bond systems and aryl groups – factors influencing the absorption. Spectroscopic terms: Chromophore, Auxochrome, Bathochromic shift, Hypsochromic shift, Hypochromic shift, Hyperchromic shift..

UNIT – V Mass spectroscopy (12 HOURS)

Basic Principles - Instrumentation – Molecular ion peak, metastable peak, base peak and isotopic peak – their uses- Nitrogen rule-Ring rule–Fragmentation of alkanes, alkenes, cycloalkane and alcohol – McLafferty rearrangement.

CONTENT BEYOND SYLLABUS

1. Rotational spectra of diatomic molecules – H_2, HCl.
2. Theory and instrumentation of Raman Spectroscopy.
3. Determination of structure of molecules using different spectroscopic techniques.

TEXT BOOKS

1. Chatwal Anand, Instrumental methods of chemical analysis, Himalaya Publishing, 1980.
2. Y.R.Sharma, Elementary Organic Absorption Spectroscopy – principles and chemical applications, S.Chand and Co., 2006.
3. K.V.Raman, R.Gopalan and P.S.Ragavan, Molecular spectroscopy, K.V.Raman, R.Gopalan and P.S.Ragavan Thomson Publications, 2004.

REFERENCE BOOKS

1. Collin N.Banwell, Mc Cash and M.Elaine, Fundamentals of Molecular Spectroscopy, Tata Mc.Graw Hill Publishing, New Delhi, 1994.

2. Jag Mohan, Organic Analytical Chemistry, Narosa Publishers, 2003.
3. William Kemp, Organic Spectroscopy, 3 rd Edition, Palgrave publishers, 2007.
4. Robert M. Silverstein, Francis X.Webster, David J. Kiemle, David L. Bryce, Spectrometric Identification of Organic Compounds, 8th Edition, 2015.
5. G. Aruldhas, Molecular Structure and Spectroscopy, PHI Learning Pvt. Ltd., 2004.

ONLINE SOURCES

1. https://nptel.ac.in/courses/122101001/downloads/lec-13.pdf
2. https://en.wikipedia.org/wiki/Rotational_spectroscopy
3. https://nptel.ac.in/courses/102103044/pdf/mod2.pdf
4. www.mssl.ucl.ac.uk/~gbr/workshop3/papers/Paerels_school_Mar17.pdf

CORE PAPER - VIII

CHEMISTRY OF NATURAL PRODUCTS

SUBJECT CODE: 17U6CHC08		
SEMESTER – VI	**CREDIT : 5**	**HOURS : 60**

OBJECTIVES

1. To gain knowledge about optical and geometrical isomerism.
2. Acquire the knowledge about heterocycles.
3. To understand the reaction mechanism and reagents in organic synthesis.

Learning Outcome

To gain an insight into basic concept of optical isomerism .

To providing theoretical understanding of heterocyclic chemistry which includes various methods of synthesis and application of those methods for the preparation of specific groups of heterocyclic systems.

To understand geometric isomerism and conformational isomerism

To acquire basic knowledge of mechanism of organic reactions.

To understand the reagents in organic synthesis

UNIT- I Fats, Oils and Wax (12 Hours)

Occurrence, properties - hydrogenation, drying of oils, hydrogenolysis, Rancidity. Analysis of oils and fats – saponification, iodine number. Synthetic detergents –classification, Occurrence of wax, difference between wax and lipids, phosphoglycerides, phosphate esters, phosphate ester acids, cell membrane.

UNIT II Alkaloids (12 Hours)

Alkaloids-classification-isolation, general methods of determination of structure of alkaloids-synthesis and structural elucidation of piperine, atropine and nicotine. Terpenes-classification, isolation, isoprene rule, synthesis and structural elucidation of citral, geraniol, alpha pinene.

UNIT III Steroids, Hormones and Vitamins (12 Hours)

Steroids – definition – Cholesterol and Ergosterol (structure only). Steroidal Harmones – Androsterones, Testrosterone, Progestrone and Oestrone (structure only). Vitamins – Introduction, Classification, occurrence and deficiency of vitamins – Structures of water and fat soluble vitamins. Synthesis of Retinol, Thiamine and Ascorbic acid.

UNIT IV Amino acids and proteins (12 Hours)

Amino acids-classification-essential and non essential amino acids-preparation of alpha amino acids-glycine, alanine and tryptophan-General properties of amino acids-Zwitter ions, isoelectric point. Peptides and proteins-synthesis of peptide- Bergmann method. Proteins-classification based on physical and chemical properties and on physiological functions-primary and secondary structure of proteins-helical and sheet structures (elementary treatment only) – Denaturation of proteins.

UNIT V Carbohydrates (12 Hours)

Classification, Reactions of Glucose and Fructose- open chain and ring structures of glucose and fructose- -mutarotation, anomers, epimers and diastereomers. Interconversion of monosaccharides- conversion of pentose to hexose and vice-versa, aldose to ketose and vice-versa. Disaccharides-structural elucidation of sucrose and maltose, Polysaccharides-structure of starch and cellulose - derivatives of cellulose.

CONTENT BEYOND THE SYLLABUS

1. Structure and of some important alkaloids, terpene such as quninine, morphine and Limonene, carvone.
2. Isomerism of amino acids, occurrence and functions in biochemistry.
3. Benefits of fats and oils, Micelle formation and their uses.
4. Carbohydrates classifications, Sources, Nutrition benefits of carbohydrates.
5. General methods of classification of steroids uses of Vitamin

TEXT BOOKS

1. Finar I.L. Organic chemistry vol I & II- ELBS, Pearson Education Ltd., 2008.
2. O.P. Agarwal- Reactions and Reagents- Krishna prakashan media (p) Ltd., 1975

3. Bhal B.S and Arun Bhal- A text book of organic chemistry, S. Chand & company Ltd, 1948.

REFERENCES

1. Kalsi P.S Stereochemistry Conformation and Mechanism-, New Age International (p) Ltd, VIIth ,2008.
2. Nasipuri D. Stereochemistry of organic compounds , second edition,Wiley Eastern Ltd., 1994.
3. K.S. Tewari, and N.K. Vishoni, Organic Chemistry, Vikas Publishing House.
4. Soni.P.L and Chawla.H.M. Text book of organic chemistry,26th revised edition, Sultan chand and sons, 1995.
5. V.K. Ahuluwalia, Rakesh kumar, Parashar R.K, Organic reaction and mechanism,IVth edition, Narosa publishing house Pvt Ltd., 2011.
6. R.T. Morrison and Boyd, Organic Chemistry, VIth edition., PHI Learning Pvt Ltd., 2008.

CORE PAPER - IX

INORGANIC CHEMISTRY – II

SUBJECT CODE: 17U6CHC09		
SEMESTER – VI	**CREDIT : 5**	**HOURS : 60**

OBJECTIVES

1. To gain knowledge about the geometry of crystals and its significance.
2. Acquire the knowledge about the different oxidation states of halogens.

Learning Outcome

To gain an insight into characterization of inorganic compounds.

To acquire basic knowledge on electronegativity of different halogens and their resulting interhalogen compounds.

To enable the students to design and synthesis pharmaceutically valuable complexes.

UNIT – I: Solid State Chemistry (12 Hours)

Crystalline and Amorphous solids – Differences – Symmetry in crystals – Basic crystal systems – Space lattice and unit cell – Bravais lattices-CCP, FCP, BCP, Packing efficiency – Miller indices – Types of crystals - Radius ratio rule and its applications – Structure of Sodium Chloride, Cesium Chloride, Zinc blende and Wurtzite. Defects in ionic crystals: Schottky, Frenkel, Metal excess and metal deficiency defects.

UNIT – II: Inter Halogens and Pseudohalogens (12 Hours)

Definition - similarities and dissimilarities between halogen and pseudohalogen - preparation, properties, structure and uses of cyanogen and thiocyanogen - Naming of the interhalogens - types, preparation, properties, structure and uses of ICl, BrF_3, IF_5, and IF_7. Basic properties of iodine.

UNIT – III: Electron Deficient Compounds (12 Hours)

Definition – Borides: structure, properties and uses – Boranes: Diborane – preparation, properties and uses - bonding in boranes – B_2H_6, B_4H_{10} – Carboranes – Wade's rule –

compounds of boron with nitrogen: preparation, properties and uses – Borazine- preparation, properties and uses

UNIT – IV: Coordination Chemistry – III (12 Hours)

Stability of complexes - Thermodynamic and kinetic stability - stepwise and overall stability constant - Factors affecting the stability of complexes.

Ligand substitution reactions in square planar complexes: The trans effect – Trans effect series – uses of trans effect – theories of trans effect – electrostatic polarization theory – π – bonding theory – mechanism of substitution reactions – factors affecting the rates of substitution reactions in square planar complexes.

UNIT-V: Organometallic Compounds (12 Hours)

Organometallic compounds: Definition – Classification based on nature of C-M bond: Ionic, σ bonded and non classically bonded. Organometallic compounds of Lithium and Boron - preparation, properties, structure and uses. Olefin complexes - Zeise's salt - synthesis and structure Cyclopentadienyl complexes - Ferrocene- preparation, properties, bonding and uses.

CONTENT BEYOND THE SYLLABUS

1. Significance of XRD studies.
2. Naturally occurring coordination complexes.
3. Compounds containing non-classical bonds.

TEXT BOOKS

1. Puri, Sharma, Kalia, Principles of Inorganic Chemistry 32nd Edition (2014), Milestone Publishers and Dustributor, New Delhi.
2. Wahid. U. Malik, G. D. Tuli, R. D. Madan, Selected topics in Inorganic Chemistry, S.Chand & company, New Delhi.
3. R. D. Madan, Satyaprakash's Modern Inorganic Chemistry, S. Chand Publishing, New Delhi.

REFERENCE BOOKS

1. Satya Prakash, G.D. Tuli, S.K. Basu and R.D. Madan, Advanced Inorganic Chemistry – Vol – I (2006), S. Chand Publishing, New Delhi.
2. Satya Prakash, G.D. Tuli, S.K. Basu and R.D. Madan, Advanced Inorganic Chemistry – Vol – II (2006), S. Chand Publishing, New Delhi.

ONLINE SOURCES

1. https://chem.libretexts.org/
2. https://www.toppr.com/guides/chemistry/the-p-block-elements/interhalogen-compounds/
3. http://chem.yonsei.ac.kr/chem/upload/CHE3103-01/119484463779670.pdf

CORE PAPER – X

PHYSICAL CHEMISTRY - II

SUBJECT CODE: 17U6CHC10		
SEMESTER – VI	**CREDIT : 5**	**HOURS : 60**

OBJECTIVES

Encourage the students to study about the phases of compound, conductance of electrolytes and learn the theory of photo-physical processes.

Learning Outcome

Students will learn the formation of metal alloy systems.

Students can understand fundamental concepts of electrochemistry and method of determinations.

Students will be improved their knowledge towards dissociation of acids, bases and salts.

Students will learn the various types of cells and electrodes.

Students will gain knowledge about the radiative and non-radiative transitions in photochemistry.

UNIT – I: Phase Rule (12 HOURS)

Statement, Explanation of terms involved in phase rule, Derivation of phase rule. One component system-water and sulphur systems-two component system - Solid – liquid equilibria – CST Lower and upper systems - simple eutectic system – Ag-Pb and KI-H_2O systems. Compound formation with congruent melting points - $FeCl_3$. H_2O and Zn-Mg systems and compound formation with incongruent melting points – K-Na alloy system.

UNIT – II: Electrochemistry – I (12 HOURS)

Faraday's laws, Ohm's law, Electrolytic conductance - specific conductance - equivalent conductance - molar conductance - variation of molar conductance and equivalent conductance with dilution. Transport number - Determination of transport number by Hittorf's method and moving boundary method. Ionic mobilities – definition and determination – Walden's rule. Kohlrausch's law – applications. Conductometric titrations – Principle, types - strong acid *vs* strong base, weak acid *vs* strong base. Advantages of Conductometric titrations.

UNIT – III: Electrochemistry – II (12 HOURS)

Debye – Huckel Theory – Ionic atmosphere – dissociation of weak acids and bases – Ionic product of water – common ion effect and its applications. pH and its determination – Hydrolysis of different types of salts – determination of degree of hydrolysis – electrical conductance method (Bredig's method). Buffer solution – pH of Buffer solution – Henderson - Hasselbalch equation. Solubility product - relation between solubility product and molar solubility - Applications of solubility product.

UNIT – IV: Electrochemistry – III (12 HOURS)

Standard cell - single electrode potential – Types of electrode - Standard Hydrogen electrode and calomel electrode – Quinhydrone electrode and glass electrode - EMF – measurements (Poggendorff's method) - Standard emf - emf series – applications. Electrochemical cells – Galvanic cell. Cell reaction and half cell reaction - cell representation. Reversible and Irreversible cells - Polarization and overvoltage. Potentiometric titration – principle, acid-base and redox titrations.

UNIT – V: Photochemistry (12 HOURS)

Electromagnetic radiation - difference between thermal and photochemical processes. Laws of photochemistry – Beer-Lambert's Law, Grothus - Draper law, Stark-Einstein law. The Jablonski diagram depicting various photo physical processes occurring in the excited state - Radiative (Fluorescence and Phosphorescence) and non-radiative (Internal Conversion and Inter system crossing) processes. Quantum yield – Definition, determination – Spectroscopic method, Agnometric method-law of photochemical equivalence. Photochemical reactions - Kinetics of hydrogen - bromine reaction - decomposition of HI.

CONTENT BEYOND THE SYLLABUS

1. Preparation and properties of metal alloys.
2. Conductance measurements of various electrolytes.
3. Different types of buffer solutions.
4. Functions of electrodes and cell reactions.
5. Calculation of quantum yield for various photochemical reactions.

TEXT BOOKS

1. Arun Bahl, B.S. Bahl and G.D. Tuli, Essentials of Physical Chemistry, Revised multicolor edition, S. Chand publication Ltd, New Delhi, 2010.
2. Puri B.R., Sharma L.R., Pathania M.S., Principles of Physical Chemistry, (47th edition) Vishal Publishing Co., New Delhi, 2017.
3. Crow D.R., Principles and Applications of Electrochemistry, 4th Edition, CRC Taylor and Francis Group, 1994.
4. Rohatgi-Mukherjee K.K., Fundamentals of Photochemistry, Revised edition, New Age International Pvt. Ltd, New Delhi, 2003.

REFERENCE BOOKS

1. Gurdeep Raj, Advanced Physical Chemistry, Krishna Prakashan Media Pvt. Ltd, 35th edition, 2009.
2. Peter Atkins and Julio de Paula, Physical Chemistry, 7th Edn, Oxford University Press, New York, 2002.
3. Yadhav M.S., Electrochemistry, Anmol Publications Pvt Ltd, Revised Edition, 2001.

ONLINE SOURCES

1. soft-matter.seas.harvard.edu/index.php
2. https://latestcontents.com/chemistry
3. https://hemantmore.org.in/science/chemistry
4. https://www.edinst.com
5. https://www.askiitians.com

ELECTIVE COURSE – II

MEDICINAL CHEMISTRY

SUBJECT CODE: 17U6CHE02		
SEMESTER – VI	**CREDIT :3**	**HOURS : 60**

OBJECTIVES

1. To help the student to understand the basic concepts in medicinal chemistry and to develop their critical thinking.
2. To learn the basics and applications of the chemical compounds as drugs in pharmaceutical industry.
3. To understand the importance of the constituents of blood and cancer chemotheraphy.

Learning Outcome

Students will learn the basic principles of chemistry involved in life sciences.

Students will have basic understanding on cancer chemotherapy and haemetology.

Students will be able to incorporate the causes of various diseases and proper usage of medicines.

Students will be able to know the different types of drugs being used in drug industry.

UNIT – I Study of Drugs **(12 Hours)**

Definition of the terms – Drug, Pharmacophore, Pharmacodynamics, Pharmacopoeia, pharmacology, pharmacokinetics, Bacteria, Virus, Fungus, Actinomycetes, Metabolites, Metabolism of drug, Antimetabolites, L_{D50}, E_{D50} . Classification of drugs, Assay of drugs – Specific methods.

UNIT – II Antibiotics **(12 Hours)**

Antibiotics – definition – classification as broad and narrow spectrum antibiotics. Structure, properties, mode of action and uses of penicillin, chloramphenicol, streptomycin, tetracycline, novobiocin, puromycin .

UNIT – III Sulphonamides **(12 Hours)**

Sulphonamides – preparation, properties and uses of sulphanilamides – mechanism and action of sulpha drugs – preparation, properties and uses of sulphadiazine, sulphapyridine, prontosil and sulphathiazole

UNIT – IV Blood and Haematological Agents (12 Hours)

Blood – composition of blood – pH of blood –blood Serum – blood grouping and matching – physiological function of plasma protein – role of blood as oxygen carrier with haemoglobin– cytochrome. Blood pressure, hypertension, clotting of blood and haemotological agents.

UNIT – V Cancer Chemotherapy (12 Hours)

Types of neoplasms – sarcoma, carcinoma, carcinosarcoma, teratoma, leukemia and polycythemia. Causes of cancer – virus and chemicals. Treatment of cancer – surgery, radiation therapy and medical therapy. Cytotoxic anticancer drugs – alkylating agents – Bis-chloroethylamines, Cyclophosphamide, Mechlorethamine, Ethyleneimines, Alkyl Sulfonates, Nitrosoureas – Miscellaneous of alkylating agents – Mode of action of Alkylating agents.

CONTENT BEYOND THE SYLLABUS

1. Students will be able to prepare simple organic compounds in lab.
2. Students can analyze and check the properties of drugs.
3. Students will be able to understand the chemistry of many chemical compounds and their use as drugs.

TEXT BOOKS

1. S.Lakshmi, Pharmaceutical Chemistry, S.Chand & Sons ,New Delhi,2004.
2. V.K.Ahluwalia and Madhu Chopra, Medicinal Chemistry ,Ane Books,New Delhi,Reprint 2009.

REFERENCE BOOKS

1. Graham Patrick, Medicinal Chemistry ,VIVA Books Private Ltd , New Delhi ,2002 .
2. Rama Rao Nadendla , Principles of Organic Medicinal Chemistry New Age International Private Ltd Publishers, New Delhi Reprint 2007.
3. P. Parimoo, A Text Book of Medicinal Chemistry,CBS Publishers,New Delhi,2006.

ONLINE SOURCES

1. https://pharmafactz.com/introduction-to-medicinal-chemistry/
2. https://en.wikipedia.org/wiki/Medicinal_chemistry
3. http://library.umac.mo/ebooks/b28050332.pdf

SKILL BASED ELECTIVE COURSE – II

POLYMER CHEMISTRY

SUBJECT CODE: 17U6CHS02		
SEMESTER – VI	**CREDIT : 2**	**HOURS : 60**

OBJECTIVES

To impart the students the knowledge of polymer materials, their formation mechanisms, properties and uses.

Learning Outcome

Students will be able to gain knowledge about the properties and classification of polymers.

Students will be able to estimate the number- and weight-average molecular masses of polymers given the degree of polymerisation and mass fraction of chains present.

Students will enhance their knowledge towards the commercially important polymers, their preparation and applications.

UNIT-I Polymers Classification and properties (12 Hours)

Monomers, Oligomers and Polymers - Degree of polymerization and its significance– Funtionality - Tacticity of Polymers (Isotactic, Syndiotactic and Atactic). Nomenclature of polymers- Homopolymers and Co-polymers. Classification of polymers - Natural, Synthetic, Organic and Inorganic Polymers - linear, cross linked and network. Physical properties of polymers - Elasticity, Tensile strength, Glass Transition Temperature.

UNIT –II Techniques and Mechanism of Polymerisation (12 Hours)

General methods of preparation of polymer-Bulk, Solution, Suspension and Emulsion polymerization. Mechanism of polymerization- Cationic, anionic, free radical and Coordination polymerization. Types of Polymerization – Condensation and Addition Polymerization. Plastics-Thermoplastic and Thermosetting Plastics

UNIT – III Molecular weight and its Determination (12 Hours)

Molecular weight and its determination: concept of Molecular weight-Number average Molecular weight-Weight average molecular weight. Methods of determining molecular weight- Osmometry, Viscometry and sedimentation.

UNIT –IV Polymer degradation and Compounding materials of polymers

(12 Hours)

Polymer degradation-Definition- Types of degradation- Thermal degradation-Mechanical degradation, Hydrolytic degradation, Photodegradation and Biodegradation. Compounding Materials of Polymers-Plastics-Fillers-Plasticizers-Colorants-Antioxidants-Stabilizers and Lubricants and Differences.

UNIT-V Industrially important polymers (12 Hours)

Individual Polymers-Polyacrylates, Polystyrene, Polyethylene, Polyvinylchloride, Polyester, Polyamides- (Nylon-6, Nylon 6,6), Kevlar-Preparation and Uses. Types of Rubber - Natural Rubber and synthetic process – Vulcanization. Fibre Reinforced Plastic (FRP) - Foamed Plastics-Conducting Polymers, polymers in biological application.

CONTENT BEYOND THE SYLLABUS

1. Bullet proof plastics.
2. Preparation of Polymer nanocomposites and their applications.
3. Polymer based solar cells and its application in energy storage.

TEXT BOOKS:

1. V,R. Gowarikar., N.V. Viswanathan: Polymer Science-Wiley Eastem limited,New Delhi.1986.
2. Textbook of Polymer Science –FW Billmeyer,Wiley-1984.
3. Dr.M.S.Bhatnagar, A Text Book Polymers, S.Chand & Company Ltd, Ram Nagar,New Delhi. Volume-II-2004.

ONLINE SOURCES

1. https://byjus.com/jee/polymers/
2. https://www.intechopen.com/books/fiber-reinforced-polymers-the-technology-applied-for-concrete-repair/introduction-of-fibre-reinforced-polymers-polymers-and-composites-concepts-properties-and-processes

CORE PRACTICAL- III

PHYSICAL CHEMISTRY PRACTICAL

SUBJECT CODE: 17U6CHCP03		
SEMESTER – VI	**CREDIT : 4**	**HOURS : 60**

OBJECTIVES

To verify the some important principles in physical chemistry and to determine various physical properties using simple instruments like conductivity meter, potentiometer, etc.

Learning Outcome

To develop skills in doing experiments in kinetics, Potentiometry and phase rule.

To make students capable of understanding and verifying principles of physical chemistry practically.

Students will gain an understanding of how to keep records of instruments, parameters, and experimental observations.

A) Kinetics

1. Rate constant determination for first order reaction-Hydrolysis of an ester in acidic medium.(Ethyl acetate or Methyl acetate)
2. Rate constant determination for second order reaction-Reaction between Potassium persulphate and Potassium iodide.

B) Conductivity

1. Determination of cell constant
2. Determination of dissociation constant for weak acid.(Acetic acid)
3. Determination of Equivalent conductance at infinite dilution for strong electrolyte.(Potassium chloride)
4. Conductometric titration-Strong acid vs Strong base-
5. Weak acid vs Strong base.

C) Potentiometry

Potentiometric titration- Strong acid vs Strong base- Weak acid vs Strong base.

D) Heterogenous Equilibrium

1. Binary system-naphthalene/biphenyl

2. Phenol/water system-determination of CST and study of effect of impurity (NaCl) on CST.
3. Determination of transition temperature for hydrated salts-sodium thiosulphate, sodium acetate, strontium chloride, manganous chloride.
4. Determination of Kf of a solvent by Rast method

TEXT BOOKS AND REFERENCE BOOKS

1. Basic Principle of Practical chemistry – V.Venkateswaran, R.Veeraswamy and A.R. Kulandaivelu, S.Chand and Sons ,NewDelhi,2004.
2. Experimental Physical chemistry V.D.Athawale,Parulmathur,Newage international publishers,2001.

ONLINE SOURCES

1. https://pubs.acs.org/doi/abs/10.1021/ed013p250.2
2. https://www.elsevier.com/books/experiments-in-physical-chemistry/wilson/978-0-08-023798-5.

CORE PRACTICAL- IV

ORGANIC ANALYSIS, PREPARATIONS AND GRAVIMETRIC ESTIMATIONS

SUBJECT CODE: 17U6CHCP04		
SEMESTER – VI	**CREDIT : 5**	**HOURS : 80**

OBJECTIVES

1. The students will get training in the quantitative analysis of metal ions using gravimetric method.
2. The students will get training for systematic qualitative analysis and preparation of simple organic compounds.

Learning Outcome

Students will learn to predict the outcome of organic reactions using a basic understanding of the general reactivity of functional groups and mechanism.

Enable the students to work effectively as a member of a team and tocCommunicate productively with lab mates, teaching assistant and instructor.

Students will learn to maintain a detailed scientific notebook.

(I) Organic Qualitative analysis:

Analysis of Organic Compounds

Characterization of organic compounds by their functional group and confirmation by preparation of derivatives. The following functional groups may be studies: Carboxylic Acids (mono and di), Phenols, Aromatic Esters, Aldehydes, Ketones, Monosaccharides, Amides, Diamides, Aromatic primary amines and Nitro compounds.

(II) Organic Preparations:

Preparations involve the following reactions:

1. Oxidation – Preparation of Benzoic acid from Benzaldehyde
2. Hydrolysis – Preparation of Methyl salicylate from Salicylic acid
3. Nitration- Preparation of p - Nitroacetanilide from Acetanilide
4. Bromination – Preparation of p - Bromoacetanilide from Acetanilide

5. Bromination – Preparation of sym - Tribromophenol from Phenol
6. Benzoylation – Preparation of Benzanilide from aniline

(III) Gravimetric Estimations

(1) Estimation of Nickel as Nickel DMG Complex

(2) Estimation Barium as Barium Chromate

(3) Estimation of Lead as Lead Chromate

NOTE:

Practical procedures will be supplied by the department.

TEXT BOOKS AND REFERENCE BOOKS

1. Dr. N.S Gnanapragasam, Organic chemistry Lab manual.
2. V. Venkateswaran, R. Veeraswamy and A.R. Kulandaivelu, Basic Principle of Practical chemistry, S. Chand and Sons, New Delhi, 2004.
3. Raj .K. Bansal, Laboratory Manual of Organic chemistry, 3rd Edition, New Age Internal Publication
4. B.S. Furniss, A.J.Hannaford, P.W.D Smith and A.R. Tatchell, Vogel's Practical Organic chemistry, 5th Edition. ELBS (1989)

ONLINE SOURCES

1. https://www.toppr.com/guides/chemistry/organic-chemistry/qualitative-analysis-of-organic-compounds/
2. https://www.csub.edu/chemistry/organic/manual/Lab14_QualitativeAnalysis.pdf
3. https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/General_Chemistry_Labs/Online_Chemistry_Lab_Manual/Chem_11_Experiments/07%3A_Gravimetric_Analysis_(Experiment)