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

MASTER OF SCIENCE (M.Sc.)

CHEMISTRY

M.Sc., CHEMISTRY
REGULATIONS AND SYLLABUS

**[FOR CANDIDATES ADMITTED FROM 2019-20 ONWARDS
UNDER AUTONOMOUS – OBE & CBCS PATTERN]**

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.

REGULATIONS

I. SCOPE OF THE COURSE

The uniqueness of the M.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. To have academic flexibility we have chosen and implemented Choice Based Credit System (CBCS) in our syllabus. To enhance the quality of students from 2019-2020, we have implemented Outcome Based Education (OBE) education system for I PG students. The OBE pattern will be extended for the II PG students in forth coming years.

II. SALIENT FEATURES

- Course is specially designed for a higher level career placement.
- Special guest lecturers 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.
- Project work is included in the syllabus to enhance conceptual, analytical and deductive skills.

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 prepared themselves in solving problems.
- ✓ Help the students to learn practical skills in a better way.
- ✓ Inculcate research aptitude in students.
- ✓ Enable the students to go to higher levels of learning chemistry.
- ✓ Improve the employability of the students.
- ✓ To inspire the students to apply their knowledge gained for the development of society in general.

IV. ELIGIBILITY FOR ADMISSION

Candidates seeking admission to the first year PG Degree course (M.Sc. chemistry) shall be required to have passed B.Sc., (Chemistry) B.Sc., (Applied chemistry) and B.Sc., (Industrial chemistry).

V. DURATION OF THE COURSE

- ➢ The course shall extend over a period of two academic years consisting of four 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 with the approval of Periyar

University.

- Each subject will have 5 and/or 4 hours of lecture per week apart from practical training at the end of academic year.

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 and the Internal Assessment Marks will be as under:

1. Average of two CIA test and Model exam - 10 Marks
2. Seminar - 05 Marks
3. Assignment - 05 Marks
3. Attendance - 05 Marks

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Total =25 Marks

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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 (Theory-75, Practicals-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 University Examinations, the passing minimum shall be 50 % out of 75 Marks for theory (38 marks) and 50% out of 60 marks for practical (30 Marks).

VIII. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Successful candidates passing the examination of Core Courses and elective courses, and securing marks

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 programme at first appearance itself.

b) 60% and above shall be declared to have passed the examinations in first class without Distinction.

c) 50% and above but below 60% shall be declared to have passed the examinations in second class.

d) Candidates who pass all the examinations prescribed for the programme at the first appearance itself and within a period of two consecutive academic years from the year of admission only will be eligible for University rank.

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 two academic years comprising of four semesters and passed the examinations prescribed and fulfiled such conditions have been 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 (i.e.,) for the students who are to be admitted to the first year of the course during the academic year 2017-18 and thereafter.

XII. COURSE PATTERN (OBE)

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN

(AUTONOMOUS)

SYLLABUS FRAME WORK

Subjects	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**						
Organic Chemistry-I & 18P1CH01	4	5	3	25	75	100	Organic Chemistry-II & 18P2CH04	5	5	3	25	75	100
Inorganic Chemistry-I & 18P1CH02	4	5	3	25	75	100	Inorganic Chemistry-II & 18P2CH05	5	5	3	25	75	100
Physical Chemistry-I & 18P1CH03	4	5	3	25	75	100	Electrochemistry and Photochemistry & 18P2CHE02	5	4	3	25	75	100
Nano chemistry & 18P1CHE01	4	4	3	25	75	100	Organic Chemistry Practical-I & 18P2CHCP01	5	4	6	40	60	100
Organic Chemistry Practical-I & 18P2CHCP01	4	-	6	-	-	-	Inorganic Chemistry-Practical-I & 18P2CHCP02	5	4	6	40	60	100
Inorganic Chemistry-Practical-I & 18P2CHCP02	5	-	6	-	-	-	Physical Chemistry-Practical-I & 18P2CHCP03	4	4	6	40	60	100
Physical Chemistry-Practical-I & 18P2CHCP03	4	-	6	-	-	-	Library	1	-	-	-	-	-
Library	1	-	-	-	-	-		-	-	-	-	-	-
Total	**30**	**19**	**12**	**100**	**300**	**400**	**Total**	**30**	**26**	**21**	**195**	**405**	**600**
							I YEAR TOTAL		**45**	**33**	**295**	**705**	**1000**
YEAR II													
Semester III							**Semester IV**						
Organic Chemistry-III & 18P3CH06	5	5	3	25	75	100	Physical Chemistry-III & 18P4CH09	5	5	3	25	75	100
Inorganic Chemistry-III & 18P3CH07	5	5	3	25	75	100	Environmental chemistry & 18P4CHE03	5	4	3	25	75	100
Physical Chemistry-II & 18P3CH08	5	5	3	25	75	100	Organic Chemistry Practical-II & 18P4CHCP04	5	4	6	40	60	100
Solar Energy & 18P3PHED01	4	4	3	25	75	100	Inorganic Chemistry-Practical-II & 18P4CHP05	5	4	6	40	60	100
Organic Chemistry Practical-II & 18P4CHCP04	5	-	-	-	-	-	Library	1	-	-	-	-	-
Inorganic Chemistry-Practical-II &	5	-	-	-	-	-	Project Work	8	9	3	60	140	200

18P4CHP05													
Human Rights & 18P3HR01	1	1	3	25	75	100							
Total	**30**	**20**	**15**	**125**	**375**	**500**	**Total**	**30**	**26**	**21**	**190**	**410**	**600**
II YEAR TOTAL									**46**	**36**	**315**	**785**	**1100**
TOTAL CREDIT FOR THE COURSE									**91**	**69**	**610**	**1490**	**2100**

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	**Core paper**	5	15	75	9	5	675	45
I	**Core practical**	5	15	150	5	4	750	20
II	**Elective**	4	15	60	3	4	180	12
II	**EDC**	4	15	60	1	4	60	4
-	**Human Rights**	1	15	15	1	1	15	1
-	**Project Work**	1	15	15	1	9	15	9
TOTAL CREDIT								**91**

XIII . BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1-Remember; **K2**- Understanding; **K3**- Apply; **K4**-Analyze; **K5**- Evaluate

1. Theory: 75 Marks

(i)Test - I & II and ESE:

Knowledge Level	Section	Marks	Description	Total
K1	A (One Mark)	20 x 01=20	Objective	**75**
K2	B (Either or pattern)	05 x 05=25	Descriptive	
K3, K4 & K5	C (Three out of five)	03 x 10=30	Detailed	

Programme Outcomes

P01: Knowledge of science: Apply the knowledge of mathematics, physics and chemistry fundamentals to understand the emerging problems and to find solutions.

P02: Problem analysis: Identify, formulate, research literature, and analyze complex problems reaching substantiated conclusions using first principles of mathematical, biological, physical and chemical sciences.

PO3: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

P04: To make the students to meet the needs of the region to have an edge to compete globally with the adequate knowledge in basic science.

Programme Specific Outcomes

On successful completion of this Programme, students will have the ability to:

PS01: think critically and analyze chemical problems.

PS02: present scientific and technical information resulting from laboratory experimentation in both written and oral formats.

PS03: work effectively and safely in a laboratory environment.

PS04: use instrumentation to gather and analyze data.

PS05: work in teams as well as independently.

PS06: apply modern methods of analysis to chemical systems in a laboratory setting.

SEMESTER I

Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	18P1CH01	**Title**	**Batch**	2019-21
		Core I – Organic Chemistry-I	**Semester**	I
Hrs/Week	5		**Credits**	05

Course Objective

To enable the students to learn about the chemistry of organic compounds and to enrich the knowledge in various organic reactions.

Course Outcomes (CO)

K1	CO1	Students will be known to name the organic compounds systematically and they will be able to asses the physical and chemical properties of organic compounds.
K2	CO2	Students can able to understand the formation of intermediates in organic reactions and the students can able to determine the mechanism of new organic reactions.
K3	CO3	Students can able to predict the aromaticity of any organic compounds.
K4	CO4	Knowledge of students will be enriched with stereochemistry and various types of substitution reactions which will help the students to carry out the research in future.
K5	CO5	Students will systematically name the natural products and will study their stereoochemistry.

Unit–I: Basics of organic chemistry (15 Hours)

Nomenclature of aromatic heterocyclic compounds (containing one or two hetero atoms) – Nomenclature of alicyclic, bicyclic and tricyclic compounds. Electron displacement effect – Inductive and field effect – Delocalised bonds – Rules of resonance – steric inhibition and steric enhancement of resonance, Hyperconjucation – hydrogen bonding – intra and inter molecular hydrogen bonding – effect of hydrogen bonding and hyperconjucation on physical and chemical properties.

SELF-STUDY: Name a tetracyclic compound with appropriate IUPAC regulations.

PRACTICAL WORK: Design a molecule in your own and mention its aromatic nature.

Unit–II: Reactive intermediates and methods of determining reaction mechanism (15 Hours)

Structure, Stability, Generation and Reactions of Carbocation (Classical and Nonclassical), carbanions, carbenes, nitrenes and free radicals. Ylides – Generation, types and reactions. Enamines - Generation and reactions.

Thermodynamic and kinetic control – methods of determination of reaction mechanisms – product analysis – determination of the presence of intermediate, isolation, detection, trapping – cross of experiments – isotopic labeling - isotopic effect – stereo chemical evidence – kinetic evidence. Microscopic reversibility – Hammond Postulate - Linear free energy relationship – Hammette equation – Taft equation - Limitations, application and deviations.

SELF-STUDY: Select any one name reactions and identify the nature of intermediate involves in that reaction.

PRACTICAL WORK: Trap the intermediate using maleic anhydride by performing appropriate reaction.

Unit–III: Aromaticity (15 Hours)

Concept of Aromaticity – aromatic character of benzene and heterocyclic compounds – benzene, pyrole and pyridine. Effect of aromaticity on bond length, resonance energy and induced ring currents. Huckels rule – concept of homoaromaticity and antiaromaticity. Nonbenzenoid aromatic compounds – cyclopropenium cation, cyclopentadienyl anion, ferrocence, diazocyclopentadiene, sydnones, azoulene, tropolone ion, tropylium ion and annulenes – their structures and aromaticity.

SELF-STUDY: Identify the aromaticity of important molecules

PRACTICAL WORK: Design a molecule in your own and mention its aromatic nature.

Unit–IV: Substitution reactions (15 Hours)

Aliphatic Nucleophilic substitution reactions: S_N1, S_N2, S_Ni mechanism – factors affecting nucleophiclic substitution - Neighbouring group participation, Ambident nucleophilies and ambient substrates. Substitution at vinyl carbon, allylic carbon and bridge head carbon. Von Braun reaction, Claisen condensation and Hydrolysis of ester. Aliphatic Electrophilic substitution reactions: S_E1 and S_E2 reactions – Mechanism and reactivity. Reaction involving the migration of double bond – Halogenation of carbonyl compounds – Stork Enamine reactions – decarboxylation of aliphatic acids. Friedel craft acylation of olifinic carbon.

Aromatic Electrophilic substitution reactions: Introduction – Mechanism of Electrophilic substitutions with examples. Orientation and reactivity – Electrophilic substitution on monosubstituted and disubstituted benzenes. Aromatic Nucleophilic substitution reactions: S_N1, S_N2 and S_N^{AR} mechanism. Typhical reactions such as Gattermann reaction, Gattermann Koch reaction, Reimer – Tiemann reaction, Koble reaction. Ziegler alkylation – Chichibabin reaction – Cine substitutions.

SELF-STUDY: What is the influence on SN1 mechanism when a substituent present on the β-carbon atom.

PRACTICAL WORK: Determine the mechanism of bromination of alcohol following kinetic studies.

Unit–V: Stereochemistry (15 Hours)

Principles of symmetry- concept of chirality, Molecualr symmetry and chirality, Newmann, Sawhorse, Fischer and Wedge representations and interconversions. Types of molecules exhibiting optical activity. Configurational nomenclature of acyclic and cyclic molecules: *cis-trans*, *E* & *Z*, *D* & *L*, (+ or –), *d* & *l*, *R* & *S*, erythro and threo; *syn* & *anti*. Stereospecific, Chemo, Regio, Enantio and stereo - selective organic tranformations, asymmetric synthesis – Crams rule.

Conformational analysis – 1,2-disubstitutd ethane derivatives – disubstituted cyclohexanes and their stereochemical features. Conformation and reactivity of substituted cyclohexanols (oxidation and acylation) cyclohexanones (reduction) and cyclohexane carboxylic acid derivatives (esterification and hydrolysis).

SELF-STUDY: Study the stereochemistry of tetrasubstituted aliphatic compounds.

PRACTICAL WORK: Workout the mechanism for reduction of cyclohexane.

CONTENT BEYOND THE SYLLABUS

1. Name a tetracyclic compound with appropriate IUPAC regulations.
2. Select any one name reactions and identify the nature of intermediate involves in that reaction.
3. Design a molecule in your own and mention its aromatic nature.
4. What is the influence on SN1 mechanism when a substituent present on the β-carbon atom.
5. Write about conformation and reactivity on oxidation of substituted cyclohexanones.

TEXT BOOKS

1. Mukargee S.H., and Singh S.P., Reaction mechanisms in organic chemistry, McMillan (1976).
2. Raj K. Bansal, Organic Chemistry Reaction mechanisms, Hill Publishing Company Ltd (2006).
3. Ernest L. Eliel, Stereochemistry of Carbon Compounds, T.M.H Edition, Tata Mc Graw-Hill Publication Companies (1975).
4. Kalsi P.S., Stereochemistry- Conformation And Mechanism, 6th Edn., New Age International Publishers (2005).

REFERENCE BOOKS

1. Jerry March, Advanced organic chemistry - Reactions mechanism and structure, McGraw Hill Kogakusha Ltd., (1977).
2. Lowry and Richardson, Mechanism and theory in organic chemistry, Harper & Row Publishers, New York (1981).
3. Finar I.L., Organic chemistry, Vol. I and Vol. II. Pearson Education (P) Ltd (2011).

ONLINE SOURCES

1. https://www.masterorganicchemistry.com/2017/02/23/rules-for-aromaticity/
2. https://chem.libretexts.org/Textbook_Maps/Organic_Chemistry_Textbook_Maps/Map%3A_Organic_Chemistry_(McMurry)/Chapter_15%3A_Benzene_and_Aromaticity/15.03_Aromaticity_and_the_Huckel_4n___2_Rule
3. www.introorganicchemistry.com
4. http://www.chem.ucalgary.ca/courses/351/Carey5th/Ch08/ch8-0.html

Mapping

PSO CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO5**	**PSO6**
CO1	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓

CO5	✓	✓	✓	✓	✓	✓	✓

Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	18P1CH02	**Title**	**Batch**	2019-21
		Core I – Inorganic Chemistry-I	**Semester**	I
Hrs/Week	5		**Credits**	05

Course Objective

1. To gain knowledge on physical and chemical properties of transition and inner transition elements.
2. To give elaborate insight into the field of nuclear chemistry.

Course Outcomes (CO)

K1	CO1	Students will learn the metallurgy and general properties of transition, and inner transition elements.
K2	CO2	Students will be introduced to the basic principles of nuclear chemistry. In future, it will help the students to explore constructive application of nuclear chemistry.
K3	CO3	Students will know the present national and international status in nuclear mission.
K4	CO4	Students will analyze the various nuclear decay process.
K5	CO5	Students will evaluate the present methodologies in nuclear waste treatment.

Unit–I: Transition Elements (15 Hours)

Position in the periodic table - Electronic configuration - General characteristics - Atomic radii - Ionic radii - Variation along the period and group - Variable valency - Colour - Magnetic properties - Catalytic property - Non-stoichiometry - Stabilization of unusual oxidation states - Structure (only) of d-block elements - $[Nb_6Cl_{12}]^{2+}$ - $[Re_2Cl_8]^{2-}$ - $[Mo_6Br_8]^{4+}$ - $[Ni_2(dmg)_2]$.

SELF-STUDY: Compare the variable oxidation of transition elements and study its effect on complex formation.

PRACTICAL WORK: synthesize a complex using d-block metal and study its catalytic activity.

Unit–II: Inner Transition Elements (15 Hours)

Position in the periodic table - Electronic configuration - Oxidation state - Solubility - Magnetic properties - Colour and Spectra - Separation of lanthanides - Lanthanide contraction - Cause and consequences - Gadalonium break - Shift reagents - Extraction of Thorium and Uranium - Comparison of lanthanides and actinides.

SELF-STUDY: Study the isotopic property of super heavier elements.

PRACTICAL WORK: Study the electrical property of inner transition elements using CV or PL.

Unit–III: Fundamentals of Nuclear Chemistry (15 Hours)

Nuclear structure-mass and charge - Nuclear moments - Binding energy - Semi empirical mass equation - Stability rules - Magic numbers - - *n/p* ratio - Nuclear forces - Modes of radioactive decay - Alpha decay - range - Ionizing power - Energy spectrum - Geiger-Nutta's rule, Theories of alpha decay - Tunnel effect - Beta decay - β^+ and β^- decay - Electron capture - Absorption - Range and Energy - Gamma ray - radioactive de-excitation - decay constant - Nuclear isomerism - Internal conversion - Auger effect.

SELF-STUDY: Study various nuclear models proposed by various scientists.

PRACTICAL WORK: Prepare a chart for studying the fragmentation process of various radioactive elements.

Unit–IV: Nuclear Reactions and Instrumental Techniques (15 Hours)

Bethe's notation - Q value - Reaction cross section - Threshold energy - Columbic barrier - Excitation function - Various types of nuclear reactions - Scattering - evaporation - photonuclear - Spallation - Fragmentation - Fission - Fusion - Stripping - Pick-up reactions - Detection and measurement of radioactivity - Proportional counter - Geiger-Muller counter - Scintillation counter - Semiconductor detector - Cloud chamber - Charged particle accelerator - Linear accelerator - Cyclotron - Beatron - Synchroton.

SELF-STUDY: Study the application of nuclear fission and fusion reactions.

PRACTICAL WORK: Construct a model for Scintillation counter.

Unit–V: Nuclear Energy and Trace Elements (15 Hours)

Nuclear fission and Nuclear reactors - Four factor formula - Characteristics of fission reactions - Product distribution of fission, Theories of fission - Fissile and fertile isotopes - Nuclear fusion and stellar energy - Fusion bomb - synthetic elements - Nuclear wastes - nuclear reprocessing - radiation hazards and prevention. Applications of isotopes - neutron activation analysis - isotopic dilution analysis - Uses of tracers in structural and mechanistic studies, agriculture, medicine and industry - Radio carbon dating - hot atom chemistry - Atomic Power Projects in India.

SELF-STUDY: Layout the working principles of H-bomb.

PRACTICAL WORK: Construct a model for nuclear reactor

CONTENT BEYOND THE SYLLABUS

1. Identify the complex used in the field of medicine.
2. List out the application of inner transition elements and their complexes in the field of medicine.
3. How to measure the radiation level in the atmosphere.
4. Mention the sub-atomic particles and their applications.
5. Write a note on Boson's particle.

TEXT BOOKS

1. 1. H.J. Arnikar, Essentials of Nuclear Chemistry, 4th Edn., New Age International (2005).
2. U.N. Dash, Nuclear Chemistry, (1971).
3. J.E.Huheey, E.A. Keiter, and R.L. Keiter, Inorganic Chemistry Principles of Structure and Reactivity, 4th Edn., Harper Collins College Publishers, New York (1993).
4. J.D. Lee, Concise Inorganic Chemistry, 6th Edn., ELBS, London (1998).
5. Samuel Glasstone, Source book of Atomic Energy, 3rd Edn., East west Press (Reprint 2000).
6. G. Choppin, J. Liljenzin, J. Rydberg, and Ekberg C., Radiochemistry and Nuclear Chemistry, 4th Edn., Elsevier, Amsterdam (2013).

REFERENCE BOOKS

1. D. Shriver, M. Weller, T. Overton, J. Rourke, and F. Armstrong, Inorganic Chemistry, 6th Edn., WH Freeman and Company, New York (2014).
2. G.L. Miessler, P.J. Fischer, and D.A. Tarr, Inorganic Chemistry, 5th Edn., Pearson Education, Inc., New York (2014).
3. C.E. Housecroft, and A.G. Sharpe, Inorganic Chemistry, 4th Edn., Pearson Education Limited, Essex (2012).

ONLINE SOURCES

1. https://chem.libretexts.org/Textbook_Maps/General_Chemistry_Textbook_Maps/Map%3A_General_Chemistry_(Petrucci_et_al.)/23%3A_The_Transition_Elements/23.1%3A_General_Properties_of_Transition_Metals
2. http://chemed.chem.purdue.edu/genchem/topicreview/bp/ch23/history.php

Mapping

PSO CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO5**	**PSO6**
CO1	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓

Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	18P1CH03	**Title**	**Batch**	2019-21
		Core III- Physical Chemistry - I	**Semester**	I
Hrs/Week	5		**Credits**	05

Course Objective

1. To impart knowledge of classifying the molecules based on symmetry and acquire knowledge in identifying the point group of the given compounds.
2. Understand the concept of kinetics and catalysis.

Course Outcomes (CO)

K1	CO1	Students will be able to identify point groups using symmetry elements and recognise symmetry operations.
K2	CO2	Students will learn to integrate knowledge to make rational answers in solving chemical problems.
K3	CO3	Students can measure the rate of a chemical reaction.
K4	CO4	Students will learn to evaluate the effect of catalyst, temperature on the rate of a chemical reaction and determine the activation energy.
K5	CO5	Students will learn and understand the importance, applications and basic aspects of surface chemistry

Unit–I: Group Theory-I (15Hours)

Principles of group theory - Symmetry elements - Symmetry operations - Properties of group - abelian, non abelian and cyclic groups - Group multiplication tables - Classes – Subgroups - Molecular point groups - Introduction of matrices - Matrix representation of symmetry elements - Reducible and irreducible representations - Properties of irreducible representation - Great orthogonality theorem and its consequences - Construction of character table for point groups (C_{2v}, C_{3V} and C_2h).

SELF-STUDY: Study about the symmetry operations of various groups.

PRACTICAL WORK: Construct a model to show various point groups.

Unit–II: Group Theory-II (15 Hours)

Applications of Group theory - Standard reduction formula relating reducible and irreducible representations - Hybridization schemes for atoms in molecules of different geometry - AB_4 tetrahedral, AB_3 triangular planar. Symmetries of vibrational modes in non-linear molecules (H_2O, NH_3 and BF_3) - Integration method - Selection rules in spectroscopy – IR & Raman active - Vibrational modes -Mutual exclusion rule - Symmetry in crystals - Hermann - Mauguin symbols- . Space groups of crystals -Translational elements of symmetry – Comparision of crystal symmetry with molecular symmetry

SELF-STUDY: Symmetries of vibrational modes in linear molecules (CO_2).

PRACTICAL WORK: Verify the selection rule for Raman active and IR inactive compounds.

Unit–III: Chemical Kinetics (15 Hours)

Reactions in solution: Comparison between gas phase and liquid phase reactions - Effect of dielectric constant and ionic strength on reactions in solutions - Primary salt effect - Influence of pressure on rates of reactions in solution - Significance of volume and entropy of activations - Study of fast reactions: Flow methods, pulse methods, relaxation methods, Chain reactions - Stationary and non stationary chain - explosion and explosion limits - Explosive reaction of H_2O_2. Linear free energy relation - Hammett and Taft equation.

SELF-STUDY: Study various reaction between solid and liquid phase.

PRACTICAL WORK: Conduct a reaction and study its kinetics.

Unit–IV: Kinetics and Catalysis (15 Hours)

Acid-base catalysis – Definitions - vant Hoff and Arrhenius intermediates - Mechanism - protolytic and prototropic catalysis laws - Bronsted catalysis law – Enzyme catalysis - Michaelis-Menten equation - Rate of enzyme catalysed reaction - Factors affecting substrate, concentration, pH and temperature on enzyme catalysed reaction - Inhibition of enzyme catalyzed reaction.

SELF-STUDY: Comparison between homogeneous and heterogeneous catalysis.

PRACTICAL WORK: conduct a reaction and study the factors affecting the rate of the reaction.

Unit–V: Surface Chemistry (15 Hours)

Adsorption - Types of adsorption - Difference between physical and chemical adsorptions - Adsorption isotherm: Freundlich's adsorption isotherm - Langmuir's adsorption isotherm and its limitations - Brunauer-Emmett-Teller (BET) adsorption isotherm and its applications - Heat of adsorption - Estimation of surface areas – B.E.T method, Titration method – Acetic acid, Nitrophenol method - Solids from solution adsorption studies - Chemisorptions: kinetics and thermodynamics - surface reactions and their mechanisms.

SELF-STUDY: Study the significance of various adsorption theories

PRACTICAL WORK: Verify Langmuir adsorption isotherm using animal charcoal.

CONTENT BEYOND THE SYLLABUS

1. Hybridization of aromatic organic molecules using group theory.
2. Role of Slater determinants in arriving hybridization of molecules.
3. Role of bio-organic catalyst in organic synthesis.
4. Different types of organic reactions and their kinetic studies.
5. Show the predominance of nanoparticles in the field of catalysis.

TEXT BOOKS

1. K.V. Raman., Group Theory, Tata McGraw - Hill Education (2004).
2. V.Ramakrishnan and M.S.Gopinathan, Group theory in chemistry, Vishal Publications, 1988.
3. A.S. Kunju, G. Krishnan., Group Theory and Its Applications in Chemistry, 2nd Edn, PHI learning private Ltd (2015).
4. B.R. Puri, L. R. Sharma, M. S. Pathania., Principles of Physical Chemistry, Vishal Publishing Co. (2016).
5. J. Rajaram and J.C.K. Kuriakose., Kinetics and mechanism of chemical transformations, Macmillan India Ltd (1993).
6. K.J. Laidler., Chemical Kinetics, Pearson (2009).
7. M.S. Gopinathan and V. Ramakrishnan., Group Theory in Chemistry, Vishal Publishers, (1988).
8. K.Veera Reddy., Symmetry and Spectroscopy of Molecules, New age international (2009).
9. Gurudeep Raj, Advanced Physical Chemistry, Goel Publishing House, (2014).

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1. F.A. Cotton., Chemical Applications of Group Theory 2nd Edn, Wiley Eastern Ltd (1989).
2. Capellos and B.H.J. Bielski, Kinetic systems, Willey interscience, Newyork, 1968.
3. P.W. Atkins., Physical Chemistry, 6th Edn, Oxford University Press, (1998).
4. Alan Vincent, Molecular Symmetry and Group theory – Programmed Introduction to chemical applications, Wiley, Newyork, 1977.

ONLINE SOURCES

1. http://vlab.amrita.edu/?sub=2&brch=193&sim=1013&cnt=1
2. http://unicorn.mcmaster.ca/teaching/4PB3/SymmetryLectureNotes2009-Vallance-Oxford-level2.pdf
3. http://cbc.arizona.edu/~salzmanr/480a/480ants/kinintro/kinintro.html
4. http://nptel.ac.in/courses/122101001

Mapping

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO5	PSO6
CO1	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓

Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	18P1CHE01	**Title**	**Batch**	2019-21
		Elective Paper - I Nanochemistry	**Semester**	I
Hrs/Week	5		**Credits**	05

Course Objective

1. To introduce the students to the world of nanotechnology.
2. To enrich the knowledge of students in novel synthetic methods to prepare nanoparticles.
3. To acquire knowledge about advanced experimental methods, to predict the chemical structure, properties, and reactivities of unique nanostructures.
4. To understand the applications of nanotechnology in diverse field.

Course Outcomes (CO)

K1	CO1	Students will acquire knowledge on various synthetic methods of nanoparticles and techniques to characterize them.
K2	CO2	Students will be able to understand various types of nanoparticles and their properties.
K3	CO3	Students learn about the promising applications of nanotechnology.
K4	CO4	Students will analyze the properties of various dimensional nanoparticles.
K5	CO5	Students will evaluate the recent advancements in nanotechnologyy.

Unit–I: Introduction to Nanoscience (15 Hours)

Introduction - History - Nanoscale & Nanotechnology - Nanotech Generation - Nanoscience - Nanocomposites - Zero dimensional nanomaterials - One dimensional nanomaterials - Two dimensional materials - Three dimensional nanomaterials. Indian and Global scenario in nanotechnology.

SELF-STUDY: Moore’s law.

PRACTICAL WORK: Prepare a chart to showing various nanoparticles and state its dimension.

Unit-II: Synthesis of Nanomaterials (15 Hours)

Physical methods - Physical Vapour Deposition (PVD). Chemical methods -Thermolysis - sonochemical approach, CVD, Electrodeposition. Precipitation methods - Thermal decomposition of complex precursors, Reduction method, sol-gel, Hydrothermal, Solvothermal method.

SELF-STUDY: Green synthesis of nanoparticles.

PRACTICAL WORK: Synthesis of one dimensional ZnO nanostructures.

Unit-III: Characterizations of nanomaterials (15 Hours)

X-ray Diffraction (XRD), Thermal gravimetric analysis TGA /Differential Scanning Calorimetry, DSC -UV spectroscopy, Photo Electron Spectroscopy (xps), Electron Microscopy: Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM)-Morphological, SAED analysis, Atomic Force Microscopy (AFM).

SELF-STUDY: EDAX, XRF.

PRACTICAL WORK: Optical property of ZnO nanoparticles.

Unit-IV: Properties and Applications of Nanaoparticles (15 Hours)

Size dependence of Properties - Chemical Reactivity – Solubility - Melting point-Electronic energy levels - Bohr radius - Optical Properties (Surface Plasmon Resonance, Quantum size effects) – Magnetic properties Size dependent properties such as coercivity and saturation magnetization. Applications (Medicine, Nanoelectronics, batteries, environmental protection, food and agriculture, energy, nanomaterial based products). Risks of nanomaterials.

SELF-STUDY: Electrical property of nanoparticles.

PRACTICAL WORK: Prepare a nano catalyst and compare its catalytic activity with bulk material.

Unit-V: Nano biomaterials (15 Hours)

Introduction: Biological building blocks - size of building blocks and nanostructures - protien nanoparticles. Nucleic Acids - DNA Double Nanowire, Genetic code and protein synthesis - Biological nanostructures - Multilayer films. Biopolymers, Biomaterials.

SELF-STUDY: Application of Biopolymers.

PRACTICAL WORK: Construct a model of DNA. Antibacterial activity of biopolymers.

CONTENT BEYOND THE SYLLABUS

1. Discuss the green synthesis of nanoparticles and its advantages.
2. Application of microwave in the synthesis of nanomaterials.
3. Application of BET in characterization of nanomaterial.
4. Application of nanoparticles in renewable energy generation.
5. Nanomaterials as superconductors.

TEXT BOOKS

1. Er. Rakesh Rathi, Nanotechnology-Technology revolution of 21st Century, S. Chand, 2013.
2. Thomas Varghese Kenneth.Klabunde, Nanoscale Materials in Chemistry, John Wiley & Sons, Inc.2002
3. Mark Ratner,Daniel Ratner, Nanotechnolgy, Pearson Education,Inc.2007
4. Nishit Mathur, Nanochemistry RBSA publishers 340, Chaura rasta ,Jaipur (2010).
5. G.Schmid (Eds),Nanoparticles, Wiley-VCH, (2004).
6. G.Hodes(Eds.), Electrochemistry of Nanomaterials , Wiley-VCH, (2001).

7. M.Kohler, W.Fritzsche, Nanotechnology, Wiley-VCH, (2004).
8. P.Ajayan, L.S.Schadler, P.V.Brawn, Nanocomposite Science and Technology, Wiley-VCH, (2003).

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1. K.L.Choy, Process principles and applications of novel and cost- effective ESAVD based methods, World Scientific Publishing, Singapore, (2002).
2. A.Jones and M.Mitchell, Nanotechnology-Commercial Opportunity, Evolution Capital Ltd. London, (2001).
3. Mick Wilson, Kannangara,Geoff Smith,Michelle simmons and Burkhard Raguse, Nanotechnology basic science and emerging technologies, overseas press.
4. Charles P.Poole, Jr., Frank J.Owens, Introduction to Nanotechnology, Wiley (reprint 2012)

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1. nptel.ac.in/courses/103103033/module9/lecture1.pdf
2. http://folk.ntnu.no/fredrol/Nanomaterials%20and%20Nanochemistry.pdf
3. https://www.ceitec.eu/nanoparticles-for-biomedical-applications/f33079
4. https://chem.libretexts.org/

Mapping

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO5	PSO6
CO1	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓

Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	18P2CH04	**Title**	**Batch**	2019-21
		Core IV - Organic Chemistry –II	**Semester**	II
Hrs/Week	5		**Credits**	05

Course Objective

1. To enrich the students knowledge in the field of reactions and reagents involved organic chemistry.
2. To impart knowledge in understanding the reaction conditions to arrive required product.
3. To understand the mechanism with which a reaction takes place.
4. To understand the various factors influencing a reaction.

Course Outcomes (CO)

K1	CO1	Students will learn the addition and elimination reactions taking place in the organic molecules.
K2	CO2	Students acquire deep understanding on diverse molecular rearrangements.
K3	CO3	Students will learn about the reagents used in organic synthesis
K4	CO4	Students will analyze the various reactions and their stereochemistry.
K3	CO3	Students will evaluate the new reagents in organic synthesis.

Unit I: Addition reactions (15 Hours)

Addition across C-C multiple bonds – Electrophillic, Nucleophillic, Free radicals, orientation and reactivity – Addition of halogen and nitrosyl chloride to olefin. Hydration of olefins and acetylenes. Epoxidation, Hydroboroation, Hydroxylation, Michael addition and Brich reduction. Diels Alder reaction, 1,3-dipolar additions. Carbenes, Nitrenes and their addition to double bond. Simmon-Smith reaction, Mannich, Stobbe, Darzen, Wittig, Wittig-Horner, Grignard, Thope and Benzoin condensation.

SELF-STUDY: List out the possible hydroboration and hydroxylation reactions.

PRACTICAL WORK: Conduct a free radical addition reaction using UV light (Bromination).

Unit II: Elimination reactions (15 Hours)

Elimination reactions – Mechanism of E_1, E_2 and E_1CB – stereochemistry of elimination, Hofmann and Saytzeff rules – competition between Elimination and substitution – Pyrolytic – Cis elimination, Chugaev reaction – Typical reactions such as Dehydration, dehydrohalogenation, Hofmann degradation, Cope elimination – Bredt's rule.

SELF-STUDY: Study about the conformational analysis for E_1, E_2 and E_1CB.

PRACTICAL WORK: Experimentally verify cope elimination reaction.

Unit III: Molecular rearrangements (15 Hours)

A detailed study of the mechanism of the following rearrangements. Wagner – Meerwin, Demyanov, Dienone–Phenol, Favorski, Baeyer – Villiger, Wolff, Stevens, Von – Richter, Beckmann, Kornblum–DeLaMare, Smiles, Jacobsen, Neber, Fries, Ireland-Claisen, Hofmann–Martius rearrangements.

SELF-STUDY: Learn about Pinacol-Pinacolane rearrangement.

PRACTICAL WORK: Carry out a reaction to verify Fries rearrangement.

Unit IV: Organic naming reactions and applications (15 Hours)

A detailed study of the following naming reactions - Biginelli reaction, Hoeben – Hoesch reaction, Vilsmeyer formylation, Bucherer reaction, Pauson – Khand reaction, Heck reaction, Suzzuki, Stille, Sonogashira, Negishi, Cadiot–Chodkiewicz coupling reactions. Huigens synthesis. Baylis-Hillman, Luche, Yamaguchi.

SELF-STUDY: Study the applications of Suzzuki coupling reaction.

PRACTICAL WORK: Conduct a Biginelli condensation reaction and find its yield and melting point.

Unit V: Reagents for Organic synthesis (15 Hours)

Aluminium chloride, Alumnium isopropoxide, N-Bromosuccinimide, OsO_4, DCC, N-Chlorosuccinimide, Diazomethane, Fenton's reagent, Hydrogen peroxide, Lead tetraacetate, Lithium aluminium hydride, Perbenzoic acid, Periodic acid, Seleniun dioxide, Sodium borohydride, $NaCNBH_3$, DDQ, Wilkinson catalyst, Wolff Kishner reagent, Wittig reagent.

SELF-STUDY: Study the oxidation reaction of various oxidising agents.

PRACTICAL WORK: Conduct a reaction using aluminium chloride as a catalyst.

CONTENT BEYOND THE SYLLABUS

1. Discuss the addition of nitrenes and carbenes upon triple bond and their stability parameters.
2. List out organic reactions performed in aqueous medium.

3. Identify the advantages of aqueous medium organic synthesis.
4. Identify the disadvantages of aqueous medium organic synthesis and find a solution to overcome the problem.
5. Write a synthetic route for the synthesis of thiazolidones, tetrazoles and oxindoles with reference to the biological applications.

TEXT BOOKS

1. Jerry March, Advanced organic chemistry - Reactions mechanism and structure, McGraw Hill Kogakusha Ltd., (1977).
2. S.H. Mukhergee and S.P. Singh, Reaction mechanisms in organic chemistry, McMillan (1976).
3. Raj K.Bansal, Organic Chemistry Reaction mechanisms, Hill Publishing Company Ltd (2006).
4. I.L. Finar, Organic chemistry, Vol. II. Pearson Education (P) Ltd (2011).

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1. S. N. Sanyal, Reactions, Rearrangements and Reagents, Bharati Bhavan Publishers & Distributor (2013)
2. V.K. Ahluwalia, Rakesh Kumar Parashar and R. K. Parashar, Organic Reaction Mechanisms
   Narosa Publishing House (2002).

ONLINE SOURCES

1. http://www.name-reaction.com/list
2. http://www.synarchive.com/named-reactions
3. https://chem.libretexts.org/
4. http://www.chem.ucalgary.ca/courses/351/Carey5th/Carey.html

Mapping

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO5	PSO6
CO1	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓

CO5	✓	✓	✓	✓	✓	✓	✓

Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	18P2CH05	**Title**	**Batch**	2019-21
		Core V- Inorganic Chemistry II	**Semester**	II
Hrs/Week	5		**Credits**	05

Course Objective

1. To impart the knowledge on types of bonding in simple and complex molecules.
2. To understand the concept of HOMO and LUMO, and their influence in bond formation.
3. To acquire knowledge about formation of complexes and their stability parameters with appropriate mechanisms.
4. To acquire knowledge about LS coupling, terms, levels, states and term symbol parity.

Course Outcomes (CO)

K1	CO1	Students will acquire sound knowledge on bonding in inorganic molecules.
K2	CO2	Students will learn the theories, mechanism of complex formation and the electronic spectra of coordination complexes.
K3	CO3	Students will acquire knowledge about term symbols and its applications.
K4	CO4	Students will analyze the bioinorganic molecules in coordination chemistry.
K5	CO5	Students will evaluate the various coordination theories.

Unit I: Ionic Bonding (15 Hours)

Ionic bonding – Lattice energy – Born equation – Born-Haber cycle - Radius ratio rule – Born Mayer equation – Kapustinskii modification – energetics of the dissolution of ionic compounds in polar solvents - polarization- Fajan's rule – results of polarization. Electronegativity – determination – Types of chemical forces – effects of chemical forces - melting and boiling points, solubility.

SELF-STUDY: Energictics of dissolution of covalent compounds in non-polar solvents.

PRACTICAL WORK: Examine and compare the melting and boiling points of various ionic and covalent compounds.

Unit II: Covalent Bonding and Molecular Structure (15 Hours)

Covalent bonding: Formal charges - Limitations of octet rule- Hybridisation and geometry - VSEPR model: CH_4, NH_3, H_2O, SF_4, BrF_3, $[ICl_2]^-$, $[ICl_4]^-$, XeF_4, $XeOF_4$, XeO_4, XeO_3, XeF_6, XeF_2 PCl_3F_2 - Bent's rule - Failures of VBT - MO theory: LCAO method - Molecular orbitals in homo nuclear diatomic molecules: O_2, Be_2, N_2 and C_2 - hetero nuclear diatomic molecules: HCl, NO and CO - HOMO and LUMO concepts in bonding.

SELF-STUDY: Molecular orbitals of Cl_2, HBr.

PRACTICAL WORK: construct a model to show molecular orbitals of ethylene molecule.

Unit III: Coordination Theories (15 Hours)

CFT: Splitting pattern of d-orbital in various environments of ligands (octahedral, tetrahedral, square-planar) - CFSE - Factors affecting the magnitude of CFSE - Weak and strong fields - Pairing energy – Jahn Teller distortion - Nephlauxetic effect - Limitations of CFT - LFT: Evidence for covalent nature of metal-ligand bonds - pi-bonding theory - Construction of MO diagram for σ and π bonded O_h complexes.

SELF-STUDY: Construction of MO diagram for σ and π bonded tetrahedral complexes.

PRACTICAL WORK: Examine the paring energy for Cu^+ and Cu^{++} complexes.

Unit IV: Reaction Mechanism in Coordination Complexes (15 Hours)

Stability of complexes, Thermodynamic and kinetic stability – stability constants - Substitution reactions: General mechanism - Schemes of octahedral, tetrahedral and square planar complexes - Trans effect - Theories of trans effect - pi-bonding theory and polarisation theory - Applications of trans effect - Catalysis by transition metal complexes: Hydrogenation of alkene (Wilkinson's catalyst), Hydroformylation (Oxo process), Wacker process and Zieglar-Natta catalysis.

SELF-STUDY: Substitution reactions of square planar pyramidal complexes -

PRACTICAL WORK: Prepare $TiCl_4$ and report its catalytic activity.

Unit V: Electronic Spectra and Organometallics (15 Hours)

Spectroscopic term symbols for d^n ions – derivation of term symbols and ground state term symbols – Energy level diagrams. Electronic spectra of complexes - Orgel diagram - interpretation of electronic spectra of d^1 to d^9 - Tanabe-Sugano diagrams - charge transfer spectra - Carbonyls: Binuclear and tri nuclear carbonyls of iron - preparation, properties, uses - Nature of M-CO bond in carbonyls - Nitrosyls - Nature of M-NO bonding - Metallocenes: Ferrocene, Cobaltocene - Preparation, Properties and structure.

SELF-STUDY: Binuclear carbonyls of Ni.

PRACTICAL WORK: Prepare a metallic complex and study its absorption spectrum.

CONTENT BEYOND THE SYLLABUS

1. Discuss the applications of organic metallics in catalysis.
2. The role of organic metallic compounds in biological systems.
3. The function of coordination compounds as homogeneous and heterogeneous catalyst.
4. Discuss on stability parameters of various metal-nitrosyl compounds.

TEXT BOOKS

1. J. E. Huheey, E. A. Keiter and R. L. Keiter., Inorganic Chemistry, 4th Edn, Pearson education (2006).
2. F. A. Cotton, G. Wilkinson., Advanced Inorganic Chemistry, 3rd Edn, John Wiley & Sons, Inc (1972).
3. W. U. Malik, G. D. Tuli and R. D. Madan, Selected topics in Inorganic Chemistry, 6th Edn S. Chand & company Ltd., (2005).
4. B. R. Puri, L. R. Sharma and K. C. Kalia., Principles of Inorganic Chemistry, S. Chand & Co (2004).
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1. C. N. Banwell., Fundamentals of Molecular Spectroscopy, Mc Graw Hill, Newyork (2001).
2. G. Raj., Advanced Inorganic Chemistry Vol. I & Vol. II, 6th Edn, Goel publishing house (1999).
3. G. S. Manku., Theoretical Principles of Inorganic Chemistry, Tata McGraw –Hill Publishing Company Ltd., (Reprint 2001)
4. R. Chang., Basic principles of Spectroscopy, McGraw Hill Ltd., New York, (1971).

ONLINE SOURCES

1. http://chemed.chem.purdue.edu/genchem/topicreview/bp/ch8/vsepr.html
2. https://chem.libretexts.org/Core/Inorganic_Chemistry/Crystal_Field_Theory/Orgel_diagrams

3. http://www.chem.iitb.ac.in/people/Faculty/prof/pdfs/L5.pdf

Mapping

PSO CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO5**	**PSO6**
CO1	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓

Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	18P2CHE02	**Title**	**Batch**	2019-21
		Elective paper II-Electrochemistry and photochemistrry	**Semester**	II
Hrs/Week	5		**Credits**	05

Course Objective

1. To impart the basic concepts electrochemistry.
2. To understand the application of electrochemistry and electrochemical cells.
3. To acquire knowledge about electrochemical reactions.
4. To enrich the students knowledge with the basic principles and application of photochemistry.
5. To study various types of photochemical reactions.

Course Outcomes (CO)

K1	CO1	Students will understand the basic principles of electrochemistry and different types of electrochemical cells.
K2	CO2	Students will learn about the basic concepts of photochemistry and their importance in various fields.
K3	CO3	Students will apply their knowledge of photochemistry in the process taking place in biosystems.
K4	CO4	Students will analyze the various electrokinetic processes.

K5	CO5	Students will evaluate the theories of electrical double layer theories.

UNIT – I: Electro chemistry – I **(12 Hours)**

Introduction to electrochemical cells-Types-Chemical cells with and without transferences-Concentration cells- types- electrode concentration cells-electrolytic concentration cells - with and without transferences - liquid junction - salt bridge - derivation- Electrical double layer, theories of double layer - Electrokinetic phenomena: Electroosmosis – electrophoresis - Diffusion, Streaming and Sedimentation potentials - electro-capillary phenomena, electro-capillary curve.

SELF-STUDY: Electrophysical processes.

PRACTICAL WORK: Construct a electrochemical cell and find its electrode potential.

UNIT – II: Electro chemistry - II **(12 Hours)**

Debye - Huckel theory of inter-ionic attraction, ionic atmosphere, time of relaxation, relaxation and - phoretic effects, Derivation of Debye-Huckel-Onsagar equation and its validity for dilute solutions at appreciably concentrated solutions. Debye-Falkenhagen and Wein effects. Mean ionic activity coefficients and their determination. Debye - Huckel Bronsted equations - Derivation of Debye-Huckel limiting law, Quantitative and qualitative verification, ion association and Bjerrum theory.

SELF-STUDY: Electrokinetic effects of electrolyte and its ionic atmosphere.

PRACTICAL WORK: Verify Debye-Huckel-Onsagar equation.

UNIT – III: Photochemistry **(12 Hours)**

Absorption of light and nature of electronic spectra, electronic transition, Frank-Condon principle, selection rules, photodissociation, predissociation, photochemical reactions: photoreduction, photo-oxidation, photodimerization, photochemical substitution, photoisomerization, photochemistry of environment: Green house effect. Photo physical phenomena: Electronic structure of molecules, molecular orbital, electronically excited singlet states, designation based on multiplicity rule, life time of electronically excited state, construction of Jablonski diagram. Stern-Volmer equation, critical energy transfer distances, energy transfer efficiency, examples and analytical significance, bimolecular collisional quenching.

SELF-STUDY: Band structure of semiconductors.

PRACTICAL WORK: Conduct a photocatalytic redox reaction.

UNIT – IV Organic Photochemistry (12 Hours)

Fundamental concepts - Photooxidation reaction (Formation of Peroxy compounds) – Photoreduction of ketones and enones, Norrish type I and II reactions-Photochemistry of Alkenes, Dienes and Aromatic compounds - Photoisomerisation – Cis and Trans isomerization - Photoaddition reaction-Paterno-Buchi reaction- Photo rearrangements - Photo–Fries rearrangement and photorearrangement of 2,5-Cyclohexadienones.

SELF-STUDY: Construction of molecular orbitals for organic molecules.

PRACTICAL WORK: Perform photochemical reaction using aromatic compounds.

UNIT – V: Applied Photochemistry (12 Hours)

Photochemistry reaction in the atmosphere - oxygen and ozone - nitrogen oxide - chlorofluoro carbons - organic compounds - chemistry of vision – photography - photosensitisers-ultraviolet screening agents - optical bleach – photochronism - photoimaging - photochemistry of polymers - Photo polymerization: imaging, curing - photodegradation and photostabilization.

SELF-STUDY: Photochemistry in biological system.

PRACTICAL WORK: Photodegradation of organic dyes.

CONTENT BEYOND THE SYLLABUS

1. Various types of batteries which are used in day-to-day life.
2. Electroplating and prevention of corrosion.
3. Recent advances in batteries and fuel cells.
4. Photooxidtion and photoreduction process in various chemical reactions.

TEXT BOOKS

1. K. K. Rohatgi - Mukharjii, Wiley Eastern., Fundamentals of Photochemistry, New age international.,(P)., Ltd., New Delhi (2011)
2. S. Glasstone, D. Van Nostrand., An introduction to Electrochemistry., Affilated East west press Pvt., Ltd., New Delhi, (2004).
3. Gurdeep Raj, Advanced Physical Chemistry, Goel Publishing House. (1999).
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1. M.S Yadav Electrochemistry- Anmol Publication Pvt Ltd. New Delhi, (2011).

2. J.G.Calverts & J.N.Pitts - An introduction to Photochemistry, New age international (p) Ltd., New Delhi. Wells, Introduction to Photochemistry, New age international (P) Ltd., (2010).

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1. http://www.engr.uconn.edu/~jmfent/CHEG320_electrochemistry%20lectures.pdff33079
2. https://web.stanford.edu/group/burnslab/meetings/13_01_24_QOphotochemistry.pdf.

Mapping

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO5	PSO6
CO1	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓

Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	18P2CHP01	**Title**	**Batch**	2019-21
		Core Practical - I Organic Chemistry Practical -I	**Semester**	I
Hrs/Week	5		**Credits**	05

Course Objective

1. The objective of this lab is to provide hands-on opportunities to apply the knowledge of chemical reaction in functional group analysis.
2. It also gives hands-on training to synthesize organic compounds via a variety of organic reactions.
3. To promote the students towards research activity and job opportunities.

Course Outcomes (CO)

K1	CO1	Students can able to investigate and report an unknown compound systematically.
K2	CO2	Students will be known to synthesize, recrystallize and finding melting point of an organic compound. It will help them to carry out their research in future.
K3	CO3	Students will apply knowledge on identifying various functional groups
K4	CO4	Students will analyze the the various separation methods.
K5	CO5	Students will evaluate different binary organic mixtures.

1. QUALITATIVE ANALYSIS OF BINARY MIXTURE OF ORGANIC COMPOUNDS :

(120 HOURS)

Preliminary pilot analysis, pilot report, bulk separation, systematic analysis of each component inclusive of preliminary identification, confirmatory tests, derivative preparation and recording melting point/boiling point of components.

2. **ORGANIC PREPARATIONS:** **(30 HOURS)**

Single stage preparation of organic compounds involving synthetic methods like oxidation, acylation, nitration, sulphonation, Bromination, Esterification, hydrolysis and condensation (six preparations).

CONTENT BEYOND THE SYLLABUS

1. Carry out any one name reaction in your laboratory and characterize the product using functional group analysis and melting point.
2. Find a method to separate unusual compositions of organic mixtures.

TEXT BOOKS

1. Antony J. Hannaford, Austin R. Tatchell, Brian S. Furniss, Peter W.G. Smith , Vogel's Text Book of practical organic chemistry, Pearson Education (2006).

REFERENCE BOOKS

1. V. Venkateswaran, R. Veeraswamy and A. R. Kulandaivelu, Basic Principles of Practical Chemistry, New Delhi, S.Chand & Co, (1995).

ONLINE SOURCES

1. http://wwwchem.uwimona.edu.jm/lab_manuals/c10expt25.html
2. http://vlab.amrita.edu/?sub=2&brch=191&sim=345&cnt=1
3. http://amrita.olabs.edu.in/?sub=73&brch=8&sim=116&cnt=1

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO5	PSO6
CO1	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓

Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	18P2CHP02	**Title**	**Batch**	2019-21
		Core Practical-II Inorganic Chemistry Practical -I	**Semester**	I
Hrs/Week	5		**Credits**	05

Course Objective

1. To acquire training in microscale experimental techniques.
2. To acquire knowledge on the properties of ions and their compounds.
3. To educate the students about the complex formation reaction, influence of pH, stability of complexes and application of complex formation reaction in analytical chemistry.
4. To impart knowledge about variation in the chemical behavior of elements in the same group.
5. To promote the students towards research activity and job opportunities.

Course Outcomes (CO)

K1	CO1	Students will learn how to conduct a process systematically and precisely.
K2	CO2	The qualitative analysis gives a type of mental training and develops a power of reasoning not equal to any other course in chemistry.
K3	CO3	The students will learn the nature, significance, and influence of errors and how they may best be avoided or minimized during qualitative and quantitative examination of a chemical compound.
K4	CO4	Students will analyze the use of complexometric titrations in water analysis
K5	CO5	Students will evaluate the rare cations using qualitative analysis.

1. Complexometric titrations: (25 HOURS)

Estimations of Ca, Cu, Mg, Ni & Zn using complexometric titration.

2. **Qualitative Analysis:** **(125 HOURS)**

Qualitative analysis employing semi micro methods and spot tests - mixtures of common cations and ions of the following less familiar elements Molybdenum, tungsten, selenium, tellurium, cerium, thorium, titanium, zirconium, vanadium, uranium and lithium.

CONTENT BEYOND THE SYLLABUS

1. Estimate the hardness of water using EDTA.
2. Analyze the given cation using different qualitative methods.

TEXT BOOKS

1. V.V. Ramanujam, Inorganic semi micro qualitative analysis, The National Publishing Co., Ltd., Madras (2002).

REFERENCE BOOKS

1. Vogel, Inorganic quantitative analysis, Pearson Education (2001).

ONLINE SOURCES

1. http://lib.hku.hk/Press/9622092128.pdf
2. http://www.kvsunjuwan.com
3. http://science-blogs.ucoz.com/resources/notes/msc/pract1/CationGuide.pdf

Mapping

PSO CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO5**	**PSO6**
CO1	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓

Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	18P2CHP03	**Title**	**Batch**	2019-21
		Core Practical-III Physical Chemistry Practical-I	**Semester**	I
Hrs/Week	5		**Credits**	05

Course Objective

1. To understand the interconnection between experimental foundation and underlying theoretical principles and to appreciate the limitations inherent in both theoretical treatments and experimental measurements.
2. To apply the principles of chemical kinetics, phase rule, electrochemistry and adsorption in the analysis of the physical and chemical properties of the given compounds.
3. To develop laboratory skills and the ability to work with instruments independently.
4. To promote the students towards research activity and job opportunities.

Course Outcomes (CO)

K1	CO1	Students will understand the breadth and concepts of physical chemistry.
K2	CO2	Students will develop skills in procedures and instrumental methods applied in analytical and practical tasks of physical chemistry
K3	CO3	Students will plan, conduct, review and report the experiment.
K4	CO4	Students will analyse the possible errors in kinetics.
K5	CO5	Students will evaluate the phase diagram in various systems.

1. Chemical Kinetics - I

Rate constant of the hydrolysis of methyl acetate catalysed by N/2 HCl

   a) Comparison of strength of two acids- at room temperatures
   b) Determination of temperature coefficient and Arrhenius parameter

2. Chemical Kinetics II – Second order reaction

   a) Saponification of ethyl acetate by NaOH

3. Phase rule studies

  a) Two component systems-Simple Eutectic formation
  b) Phase diagram of a two-component system forming compound (with congruent melting point).

4. Heat of solution of benzoic acid in water.

5. Verification of Freundlich adsorption isotherm (Adsorption of oxalic acid on Charcoal).

6. Conductometric titrations
    a) CH_3COOH vs NaOH
    b) HCl, CH_3COOH vs NaOH

  Application :
    a) Verification of DHO equation
    b) Verification of Ostwalds' dilution law
    c) Estimation of mixture of halides.

7. Potentiometric titrations
    a) CH_3COOH vs NaOH
    b) HCl, CH_3COOH vs NaOH
    b) KCl vs $AgNO_3$
    c) Estimation of mixture of halides.
    d) Determination of $E^0, Zn^{2+}/Zn$ and estimation of Zn^{2+}.

CONTENT BEYOND THE SYLLABUS

1. Apply the principle of conductometric method for a precipitation titrations.
2. Apply principles of second derivative graphical method for potentiometric titrations.
3. Construct a cell using different electrolytes an calculate their E_{cell} value and single electrode values.
4. To study the time consumption of various reactions.

TEXT BOOKS

1. A .O. Thomas , Practical Chemistry, Scientific Book Centre , Cannanore (2003).
2. V. Venkateswaran, R. Veeraswamy and A. R. Kulandaivelu, Basic Principles of Practical Chemistry, New Delhi, S.Chand & Co, (1995).

REFERENCES

1. B Viswanathan, P.S. Raghavan, Practical Physical Chemistry, Viva Books Private Limited, (2005).

ONLINE SOURCES

1. http://nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Material Science
2. http://qu.edu.iq/el/pluginfile.php/69663/mod_resource/content/1/lect%2023_Conductometric%20Titrations.pdf
3. http://www.cffet.net/sia-e/2_Pot_titr.pdf

Mapping

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO5	PSO6
CO1	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓

18P1CH01

VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN

(AUTONOMOUS)

DEPARTMENT OF CHEMISTRY

M.Sc. DEGREE EXAMINATION - I SEMESTER

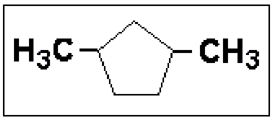
MODEL QUESTION- ORGANIC CHEMISTRY - I

Time: 3 hrs **Max Marks: 75**

PART - A

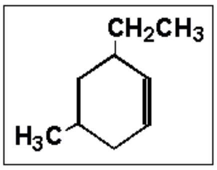
Answer all the questions **20 X 1 =20**

1. Select the correct IUPAC name for:



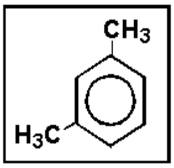
a) 1,4-dimethylcyclopentane b) 1,3-dimethylcyclopentane
c) 2,5-dimethylcyclopentane d) 2,3-dimethylcyclopentane

2. Name the following compound:



a) 2-ethyl-4-methylcyclohexene b) 6-ethyl-3-methylcyclohexene
c) 3-ethyl-5-methylcyclohexene d) 2-ethyl-4-methylcyclohex-1-ene

3. The following chemical structure represents a molecule of what molecular formula?



a) C_8H_{10} b) C_6H_6 c) C_6H_8 d) C_8H_{12}

4. Electron density moves towards the functional groups in the following event.

a) Inductive effect b) Mesomeric effect

c) Hyperconjugation d) Hydrogen Bonding

5. Which of the following is an intermediate in the reaction of benzene with CH_3Cl and $AlCl_3$?
a) Methyl radical b) methyl carbanion c) methyl carbocation d) phenyl carbo cation

6. Which one of the following is an example for ylide,

a) $(Ph)_3P=CH_2$ b) $(Ph)_3P-CH_3$ c) $(Ph)_2PH-CH_3$ d) $(Ph)_3C=CH_2$

7. Which one of the following statement is correct regarding ylides?

a) Ylides are 1,2-dipolar compounds b) Ylides are non-polar compounds

c) Ylides are non-zwitterionic compounds d) None of the above

8. Which one of the following is being used in isotopic labeling?

a) ^{2}H b) ^{16}O c) ^{12}C d) ^{14}N.

9. Which one of the following is non-aromatic,

a) Cyclopentadiene b) Benzene c) Cyclopentadienyl anion d) Naphthalene

10. The ring containing………… hybridized carbon atom is non-aromatic ,

a) sp^2 b) sp^3 c) sp d) none of the above

11. Which of the following compound is aromatic?

a) Pyridine b) pyrrole c) pyrrolidine d) piperidine

12. Which one of the following is non-aromatic?

a) cyclopentadienyl anion. b) cyclopropane

c) cyclopropenium cation. d) ferrocene

13. Hydrolysis of an ester usually results ---------------------?

a) Ketone and acid b) Acid and alcohol

c) Dicarboxylic acid d) Secondary amine

14. Nucleophilic substitution reaction takes place when Halogenoalkanes is added with aqueous solution of

a) Sodium chloride b) Sodium mangnate c) Sodium hydroxide d) Sodium chlorate.

15. Reaction involving breakdown of water molecule is known as

a) Heterolytic b) Hydrolysis c) Homolytic d) All of them

16. Which one of the following is a catalyst for the Reimer – Tiemann reaction

a) $CO/HCl/AlCl_3$ b) $CO_2/HCl/AlCl_3$

c) $O_2/HCl/AlCl_3$ d) None of the above

17. Which of the compounds below exists as only three stereoisomers?

a) 1,4-dibromobutane b) 2,3-dibromobutane

c) 2,3-dibromopentane d) 1,1-dibromocyclopentane

18. What is the best definition of tautomers?

a) constitutional isomers that readily interconvert.

b) stereoisomers that do not have a mirror image relationship.

c) structures that differ only by rotation around single bonds

d) structures that have strained carbon-carbon bonds due to steric interactions.

19. The carbohydrate D-threose (CHO) – $[CH(OH)]_2$-CH_2OH have the following absolute configuration

a) (2R, 3R) b) (2R, 3S) c) (2S, 3R) d) (2S, 3S)

20. Consider the reaction of trans-2-butene with Br2 in CH2Cl2. Which statement concerning this reaction is correct?

a) The product is optically inactive because it is a racemic mixture of enantiomers.

b)The product is optically inactive because it is meso

c) The product is optically inactive because it does not possess any chirality centers.

d) The product is optically inactive because it is a racemic mixture of diastereomers.

Answer all the questions **5 X 5=25**

21. a) Write the name of the following compounds. **(OR)**

b) (i) Chloroacetic acid more acidic than acetic acid. Why?

(ii) Why phenol is more acidic the ethanol?

22. a) Give the order of stability of following carbocations.

(i) tropylium ion (ii) Benzyl cation (iii) t-butyl carbocation

(iv) Isopropyl carbocation (v) di-t- butyl carbocation

(OR)

b) Explain the microscopic reversibility with example?

23. a) Predict the aromatic, non-aromatic and anti aromatic nature in the following compounds.

(i) cycloheptatriene (ii) cyclobutadiene (iii) cyclooctatetrane

(iv) cyclopentadienyl anion (v) pyridine

(OR)

b) Define Homoaromaticity and Anti aromaticity.

24. a) Show that nucleophilic substitution influence by neighbouring group . **(OR)**

b) Explain the concept of orientation and reactivity using disubstituted benzene.

25. a) Give an example for regioseletive organic transformation. **(OR)**

b) Analyse the conformations of di-substituted cyclohexane .

PART - C

Answer any three of the following questions **3 X 10 = 30**

26. Explain the effect of hydrogen bonding and hyper conjugation on physical and chemical properties of the molecule?

27. Explain stability, structure and generation of carbenes and nitrenes ?

28. Explain with example about effect of aromaticity on band length, resonance energy and induced ring current.

29. Explain the mechanism of Stork Enamine reaction and Friedal Craft acylation of olifinic carbon.

30. Explain the optical inactivity of meso tartaric acid using Fischer, Newmann and Sawhorse projection formulas?

18P1CH02

VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN
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DEPARTMENT OF CHEMISTRY
M.Sc. DEGREE EXAMINATION - I SEMESTER
MODEL QUESTION- INORGANIC CHEMISTRY - I

Time: 3 hrs **Max Marks: 75**

PART - A

Answer all the questions **20 X 1 =20**

1. Zinc does not show variable valency because of

   a) complete d-sub shell b)inert pair effect c) $4s^2$ sub shell d) none of these.

2. Which one of the following ion exhibit colour in aq. solution

   a) Sc^{3+} b) Ni^{2+} c) Ti^{4+} d)Zn^{2+}.

3. Which one of the following is diamagnetic ion

   a) Sc^{3+} b) Mn^{2+} c) Cu^{2+} d) Co^{2+}.

4. All the metals form oxides of the type MO except

   a)Pb b)Cu c)Ba d)Ag.

5. Lanthanide contraction is caused due to,

   a)the appreciable shielding on outer electrons by 4f electrons from the nuclear charge

   b)the appreciable shielding on outer electrons by 5d electrons from the nuclear charge

   c)the same effective nuclear charge from Ce to Lu

   d)the imperfect shielding on outer electrons by 4f electrons from the nuclear charge.

6. The outer electron configuration of Gadolinium Gd (Atomic number 64) is,

   a) $4f^3 5d^5 6s^2$ b) $4f^8\ 5d^0\ 6s^2$ c) $4f^4\ 5d^4\ 6s^2$ d) $4f^7\ 5d^1\ 6s^2$

7. The outer electron configuration of Lanthanum La (Atomic number 57) is,

   a) $4f^3 5d^5 6s^1$ b) $4f^8\ 6s^2$ c) $4f^4\ 5d^3\ 6s^2$ d) $5d^1\ 6s^2$

8. The reason for the stability of Gd^{3+} ion is,

   a) Half filled 4f shell b) empty 4f shell c) Completed 4f shell d) Possess the electronic configuration of inert gas.

9. The 'magic number' for atoms are,

   a) the numbers of electrons that confer atomic stability

   b) numbers of protons and/or neutrons that confer nuclear stability.

   c) n/p ratios that confer nuclear stability.

   d) atomic masses that confer nuclear stability.

10. The actual mass of ^{37}Cl atom is 36.966 amu. The calculated mass defect (amu/atom) for a ^{37}Cl atom is,

    a) 0.623 amu b) 0.388 amu c) 0.263 amu d) 0.341 amu

11. Which of the following sentence is incorrect?

    a)Mass defect is the amount of matter that would be converted into energy if a nucleus were formed from initially separated protons and neutrons.

b)Nuclear binding energy is the energy released in the formation of an atom from subatomic particles..

c) Mass number is the sum of all protons and electrons in an atom.

d) Nuclei with highest binding energies are the most stable nuclei.

12. Which one of the following statements about nuclear reactions is false?

a) Particles within the nucleus are involved.

b) No new elements can be produced.

c) Rate of reaction is independent of temperature.

d)They are often accompanied by the release of enormous amounts of energy..

13. Which of the following describe the nuclear fission process?

a) A heavy nucleus is fragmented into lighter ones..

b) A neutron is split into a neutron and proton.

c) Two light nuclei are combined into a heavier one.

d) A proton is split into three quarks.

14. When ^{235}U is bombarded with one neutron, fission occurs and the products are three neutrons, ^{94}Kr, and _____

a) ^{142}I b) ^{139}Xe c) ^{141}Ba d) ^{139}Ba.

15. The cyclotron is used to

a) Accelerating Particles b) Seperating elements

c) Purifying elements d) Making alloys.

16. The largest synchrotron-type accelerator, also the largest particle accelerator in the world, is

a) Large Hadron Collider (LHC) near Geneva, Switzerland, built in 2008 by the European Organization for Nuclear Research (CERN).

b) Birmingham synchrotron, University of Birmingham, UK

c) Synchrophasotron, JINR, Dubna, Russia

d) INDUS-I, INDUS-II, Raja Ramanna Centre for Advanced Technology, Indore, India.

17. Radiocarbon dating is useful technique for all the samples, except

a) wood b) Bone c) Shells d)Granite

18. India's Kudankulam Nuclear power plant is a collaborative project with

a) Australia b) China c) Russia d) Pakistan

19. To trace the path of phosphorus, the isotope of phosphorus which is added to the fertilizers, is

a) Phosphorus-31 b) Phosphorus-32 c) Phosphorus-33 d) Phosphorus-34

20. The half life of Carbon-14 is

a) 1200 years b) 5400 years c)7200 years d)5730 years

PART-B

Answer all the questions 5 X 5=25

21. a) Explain the variation of atomic and ionic radii along the group and period. **(OR)**

    b) Draw the structure of $[Nb_6Cl_{12}]^{2+}$ and $[Re_2Cl_8]^{2-}$.

22. a) What is meant by lanthanide contraction? Explain its causes and consequences. **(OR)**

    b) How do you relate colour and spectra in inner transition elements?

23. a) What is meant by electron capture reactions? Explain with examples. **(OR)**

    b) Write a note on auger effect.

24. a) Explain the principle and working of Geiger – Muller counter. **(OR)**

    b) Compare Cyclotron, Betatron and Synchrotron.

25. a) What are fissile and fertile isotopes? Explain with examples. **(OR)**

    b) Write a brief note on atomic power projects in India.

PART - C

Answer any three of the following questions 3 X 10 = 30

26. Why transition elements possesses variable oxidation state?

    Write a note on catalytic property of transition elements.

27. How do you extract lanthanides from monazite sand?
28. Describe in detail about Shell and Liquid drop model.
29. Explain the various types of nuclear reactions with example.
30. How do you prevent nuclear wastes?

18P1CH03

VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN
(AUTONOMOUS)
DEPARTMENT OF CHEMISTRY
M.Sc. DEGREE EXAMINATION - I SEMESTER
MODEL QUESTION- PHYSICAL CHEMISTRY - I

Time: 3 hrs **Max Marks: 75**

PART – A

Answer all the questions **20 X 1 =20**

1. Which of the following does not contain a C_3 axis?

a) $POCl_3$ b) $[NH_4]^+$ c) $[H_3O]^+$ d) ClF_3

2. Which two species belong to the same point group?

a) XeF_2 and OF_2 b) H_2O and CO_2

c) H_2S and OF_2 d) $[NO_2]^+$ and $[NO_2]^-$

3. SO_2 belongs to which point group?

a) C_2v b) C_2 c) $D_\infty h$ d) C_2h

4. The number of degrees of vibrational freedom possessed by CH_4 is

a) 10 b) 6 c) 4 d) 9

5. An O_h XY_6 molecule exhibits two T_{1u}, IR active modes. Which statement is true?

a) Each T_{1u} mode is triply degenerate, and each gives rise to one absorption in the IR spectrum of XY_6

b) Each T_{1u} mode is triply degenerate, and each gives rise to three absorptions in the IR spectrum of XY_6

c) Each T_{1u} mode is non-degenerate, and gives rise to one absorption in the IR spectrum of XY_6

d) One of the T_{1u} modes is the symmetric stretching mode of XY_6

6. The symmetric stretching mode of the SiF_4 molecule

a) is IR active b) is IR inactive c) generates a change in molecular dipole moment d) gives rise to a strong absorption in the IR spectrum

7. CO_2 has

a) 3 vibrational modes b) 4 vibrational modes, 2 of which are degenerate

c) stretching modes only d) an IR active symmetric stretch

8. Which pairing of molecule and point group is correct?

a) BCl_3, C_3v b) $SiCl_4$, D_4h c) H_2S, C_2v d) SF_4, C_4v

9. The rate constant in min^{-1} is

a) 69.3 b) 0.0693 c) 6.93×10^{-4} d) 6.93

10. The rate constant of a reaction changes when

a) pressure is changed b) concentration of reactants changed

c) temperature is changed d) a catalyst is added

11. Hammett plots may not always be perfectly

a) linear b) slope c) curve d) all the above

12. Which of the following steps corresponds to a branching step in a radical chain reaction? Radicals are not explicitly shown in the equations.

a) $_2Br \rightarrow Br_2$ b) $CH_3 + Cl_2 \rightarrow CH_3Cl + Cl$ c) $HBr + H \rightarrow H_2 + Br$

d) $H + O_2 \rightarrow OH + O$

13. Which of the following statements is correct in enzyme kinetics, if S represents the substrate?

a) At very low substrate concentration, the rate of enzyme reaction is zero order with respect to [S].

b) At very high substrate concentration, the rate of enzyme reaction is zero order with respect to [S].

c) At all a substrate concentration, the rate of enzyme reaction is first order with respect to [S].

d) At very high substrate concentration, the rate of enzyme reaction is first order with respect to [S].

14. In enzyme kinetics, V represents the reaction velocity and S is the substrate. In a Line weaver-Burk treatment of data, which of the following plots would give you a straight line of gradient K_M/V_{max} where K_M is the Michaelis constant and V_{max} is the maximum velocity?

a) V against 1/[S] b) 1/V against [S] c) 1/V against 1/[S] d) V against [S]

15. A reaction has activation energy of 20kcal/mol. A 10 °C rise in temperature results in a doubling of the rate. What is the original temperature? (R=1.985 cal/mol/K)

a) 376.3K b) 376.9K c) 376.2K d) 376.5K

16. In the equation k=A exp(-E/RT), A is called

a) Temperature b) gas constant c) rate constant d) pre-exponential

17. In Freundlich Adsorption isotherm, the value of 1/n is

a) 1 in case of physical adsorption b) 1 in case of chemisorption

c) between 0 and 1 in all cases d) between 2 and 4 in all cases

18. What will be the intercept in a graph of Freundlich adsorption isotherm?

a) k b) log k c) 1/a d) 1/n

19. In adsorption of oxalic acid on activated charcoal, the activated charcoal is known as

a) Adsorbent b) Absorbate c) Adsorber d) Absorber

20. The B.E.T. theory was based on the

a) Single layer adsorption b) Multilayer adsorption

c) Double layer adsorption d) None of the mentioned

PART – B

Answer all the questions 5 X 5=25

21. (a) Discuss symmetry elements and symmetry operations in a molecule. **(OR)**

(b) Explain group multiplication table.

22. (a) Explain hybridisation schemes for AB_4 tetrahedral. **(OR)**

(b) Explain Mutual exclusion principle.

23. (a) Write a note on Primary salt effect with proper example **(OR)**

(b) Define fast reaction. Explain Flow method.

24. (a) Discuss Vonthoff intermediates. **(OR)**

(b) Write a note on Bronsted catalysis law.

25. (a) Write a note on Freundlich adsorption Isotherm. **(OR)**

(b) How will you differentiate physical and chemical adsorption isotherm.

PART - C

Answer any three of the following questions 3 X 10 = 30

26. What is a character table? How will you construct the character table for C_2v point group

27. Discuss the symmetry selection rule and raman spectra.

28. Explain hammet equation and Taft equaton.Explain what are the factors affecting it.

29. Briefly explain Michaelis-Menton equation of enzyme catalysed reactions

30. Derive the Langmuir adsorption isotherm. What are its limitations.

18P1CHE01

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)

DEPARTMENT OF CHEMISTRY

M.Sc. DEGREE EXAMINATION

MODEL QUESTION- NANO CHEMISTRY

Time: 3 hrs **Max Marks: 75**

PART - A

Answer all the questions 20 X 1 =20

1. "There is a plenty of room at the bottom." This was stated by
   a) Issac Newton b) Albert Einstein
   c) Richard Feynman d) Eric Drexler

2. 1 nanometre= _______ cm.
   a) $10^{(-9)}$ b) $10^{(-8)}$ c) $10^{(-7)}$ d) $10^{(-6)}$

3. ----------- is a one dimensional nanomaterial.
   a) Quantum dot b) Spherical nanoparticles
   c) Nanosheet d) Nanorod

4. --------- is a top-down method.
   a) citrate reduction method b) Hydrogen reduction method
   c) Sputtering d) co-precipitation

5. ---------- can be used as a capping agent.
   a) Esters b) Amide c) Hydrocarbons d) Amines

6. Bigger particle grow at the expense of smaller particles is called -----------
   a) Ostwald ripening b) phase transformation
   c) agglomeration d) polycrystallisation

7. Metal nanoparticles can be prepared by --------------
   a) reduction of metal ion b) solgel method
   c) coprecipitation method d) none of the above

8. Friction, trubulence, bubble formation and collapse of bubbles are the steps in
a) microwave synthesis b) PVD synthesis
c) sonochemical synthesis d) CVD synthesis

9. $\tau = \frac{0.9\lambda}{\beta cos\theta}$ is -------- equation
a) Willimson b) Hall c) Debye-Scherrer d) Tac

10. XPS is used to measure ---------
a) elemental composition of the surface b) chemical state of surface elements c) electronic state of surface elements d) all of the above

11. Thermal stability of the nanoparticles can be measured using --------
a) UV b) TEM c) SEM d) TGA

12. Tac plot is used to calculate --------.
a) optical band gap b) electrical band gap
c) particle size d) particle density

13. Surface plasmon resonance is a property of ------- nanoparticles.
a) oxide b) sulphides c) metal d) polymeric

14. ZnO is used in -----------
a) solar cells b) anti-micorbial coating
c) sun screen lotion d) all of the above

15. Hystersis loop is a characterstic property of ---------- nanoparticles.
a) semiconductos b) ZnO c) Magnetic nanoparticles d) ZnS

16. Melting point of nanoparticles are ----- the bulk.
a) equal to the bulk b) greater than the bulk
c) lesser than the bulk d) independent of size

17. An example of nucleic acid is ---------
a) protein b) fats c) DNA d) none of the above

18. Amino acids are building blocks of ----------
a) cells b) tissues c) vitamins d) proteins

19. ---------- is an example of biopolymer.
a) PVC b) Polypyrrole c) PVP d) celluose

20. ---------- is a biodegradable polymer
a) PVC b) HDPE c) LDPE d) Cellulose

PART - B

Answer all the questions **5 X 5 = 25**

21. a) Explain the Zero dimensional nanoparticles. **(OR)**

b) Write a note on nanosensors.

22. a) Write a note on hydrazine and borohydride reduction. **(OR)**

b) Explain the sol gel synthesis.

23. a) Explain the principle and working of X-ray photoelectron spectroscopy. **(OR)**

b) Explain the instrumentation and working for UV spectroscopy.

24. a) Write a note on nanocatalysis. **(OR)**

b) Write short note on biomedical applications.

25. a) Explain the protein synthesis. **(OR)**

b) Explain the multilayer films.

PART – C

Answer any three of the questions **3 X 10 = 30**

26. Explain Indian and global scenario in nanotechnology.
27. Explain the pulse laser deposition.
28. Explain the Thermal Gravimetric Analysis(TGA).
29. Briefly explain the properties and applications of metal nanoparticles.
30. Briefly explain the biological nanostructures.

18P2CH04

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)

DEPARTMENT OF CHEMISTRY

M.Sc. DEGREE EXAMINATION

MODEL QUESTION- ORGANIC CHEMISTRY - II

Time: 3 hrs **Max Marks: 75**

PART - A

Answer all the questions. **20 X 1 =20**

1. Ethylene is …………….. compound

   a) a saturated b) an unsaturated c) an alkyne d) none of the above.

2. How will you prepare 1-bromo-2-methyl-cyclopentane from 1-methyl-1-hydroxy cyclopentane

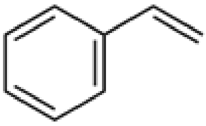
   a)acid/dehydration, followed by HBr addition

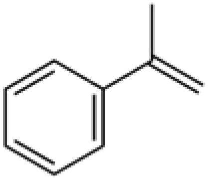
   b)hydration, followed by HBr addition

   c) substitution of Br followed by elimination of OH

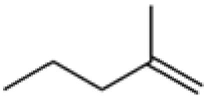
   d) none of the above

3. Which alkene is the most reactive in acid-catalysed hydration?

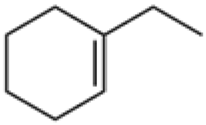
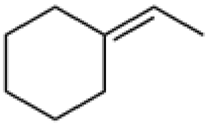
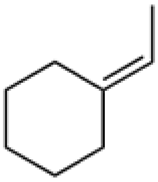
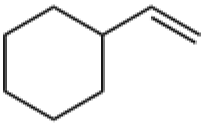
a) 

b) 

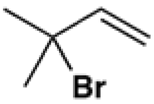
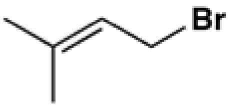
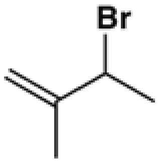
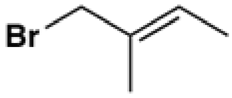
c) 

d) 

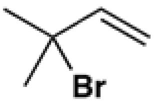
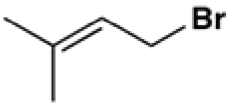
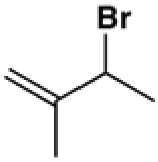
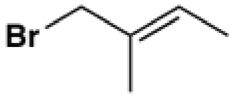
4. Which of the following alkenes gives a main product different from the products from the others in reactions with hydrogen chloride?

a)  b)  c)  d) 

5. Which is the main product when 2-methylbuta-1,3-diene reacts with one equivalent of HBr for a limited time below 0 °C?

a)  b)  c)  d) 

6. Which is the main product when 2-methylbuta-1,3-diene reacts with one equivalent of HBr for a limited time below 0 °C?

a)  b)  c)  d) 

7. Losing of small molecule from original organic molecule is

a) elimination reaction b) substitution reaction c) addition reaction
d) both A and B

8. If ethanol will be used in elimination reaction of Halogenoalkanes it will produce

a) alkanes b) alkenes c) ketonen d) carbonyl

9. During elimination reaction of Halogenoalkanes reagent use is

a) ethanolic sodium hydroxide b) ethanoic acid c) ethanoate d) ethane

10. In the Wagner-Meervin rearrangement the following is happened

a) formation of carbocation, protonation, , formation of alkene
b) protonation , elimination of water, formation of alkene
c) hydration , elimination of water, formation of alkyne
d) none of the above

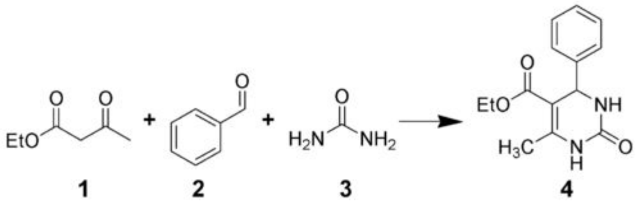
11. Fries rearrangement will result in the formation of

a) aromatic acids b) acyl phenols c) ketonic acid d) phenolic aldehyde

12. The formation of ester from the ketone in presence of peroxyacids or peroxides can be called as
    a) Fries rearrangement　　b) Bayer-Villiger rearrangement
    c) Beckmann rearrangement　　d) Hoffmann-Martius rearrangement

13. Beckmann rearrangement is an ....
    a) acid catalysed rearrangement of an oxime to substituted amide
    b) acid catalysed rearrangement of an oxime to substituted alcohol
    c) acid catalysed rearrangement of an oxime to substituted alkane
    d) None of the above

14. What is the name of the following reaction



a) Still reaction　b) Biginelli reaction　c) Suzzuki reaction　d) Hoffmann-Martius rearrangement

15. Which one of the following is and Yamaguchi reagent
    a) 2,4,6-trichlorobenzoyl chloride　b) 1,4,6-tribromobenzoyl chloride
    c) 2,4,6-triiodobenzoyl chloride.　d) None of the above.

16. Which one of the following is a catalyst for Heck reaction

    a) Na/Hg b) Pd c) SnO d) Charcoal

17. The Baylis-Hillman reaction is an organic reaction used to form a

    a) C-C bond　b) N-N bond　c) O-O bond　d) C-N bond

18. OsO_4 is a volatile liquid that is most useful for the synthesis of .... from alkenes.

    a) 1,2-diketones　b) 1,2 diols　c) 1,3- diols　d) none of the above

19. Lead tetraacetate is an important laboratory

    a) Reducing agent　b) Oxidizing agent　c) acetylating agent　d) none of the above

20. Which one the following can be used to generate epoxides

    a) Ethanol　b) OsO_4　c) perbenzoic acid　d) leadtetraacetate

PART - B

Answer all the questions. 5 X 5 = 25

21. (a) Addition reaction of alkenes leads totrans product. Why? **(OR)**
    (b) Write a note on addition derivatives of ammonia to carbonyl compounds
22. (a) Discuss E1CB mechanism **(OR)**
    (b) State and explain Hoffman and Saytzeff rule.
23. (a) Write a notes on DeLa mare rearrangement **(OR)**
    (b) Discuss the Neber rearrangement .
24. (a) Explain 1,3-diploar addition in Biginelli. **(OR)**
    (b) Write a notes on Pauson-Khand reaction
25. (a)Explain the role of $AlCl_3$ in Friedal Craft's reaction and Fries rearragement **(OR)**
    (b)Write the application of DDQ

PART – C

Answer any three of the following questions 3 X 10 = 30

26. Explain the following addition reaction with mechanism (i) Simmon-smith reaction (ii) Wittig-Horner reaction
27. Give the mechanism of Cope elimination and Hoffmann degradation
28. Explain Demyanov and Smiles rearragement
29. Explain the mechanism of Luche and Suzzuki reactions
30. Explain the application of OsO_4 and $Pb(COOMe)_4$ in organic synthesis

18P2CH05

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)

DEPARTMENT OF CHEMISTRY

M.Sc. DEGREE EXAMINATION

MODEL QUESTION- INORGANIC CHEMISTRY - II

Time: 3 hrs **Max Marks: 75**

PART – A

Answer all the questions **20 X 1 =20**

1. Which of the following molecule have ionic bond?

   a) O_2 b) Cl_2 c) NaCl d) SO_2

2. Which factor is used to determine if a bond is considered ionic

   a) Electronegativity b) mass c) size d) number of atoms bound.

3. Which element in periodic table possess highest electronegativity

   a) Hydrogen b) Carbon c) Fluorine d) Helium

4. Which element in periodic table possess highest electronegativity next to fluorine

   a) Pb b) O_2 c) Ba d) Ag.

5. What kind of hybrid orbitals are utilized by the carbon atom in CH_4 molecules?,

   a) sp^2 b) sp^3 c) sp d) d^2sp

6. Which one of the following violate the octet rule?,

   a) AsF_5 b) NF_3 c) PCl_3 d) CBr_4

7. Carbon monoxide has ten bonding electrons and four antibonding electrons. Therefore it has a bond order of,

   a) 3 b) 7 c) 1 d) 2

8. The atoms in water molecule adopt what kind of geometry if you include the lone pair of electrons?,

   a) Linear b) Tetrahedral c) Pyramidal d) Octahedral

9. sp^3 hybridization involves the hybridization of how many atomic orbitals?

   a) 3 b) 2 c) 4 d) 5

10. The geometry of XeF_4 is ----------- from the VESPR theory

    a) tetrahedral b) angular c) trigonal planar d) Square planar

11. How many unpaired electrons are there in the strong field Iron(II) octahedral complex

    a) 1 b) 2 c) 0 d) 4

12. Strong field ligands such as CN^-

    a) usually produce low spin complexes and high crystal field splittings.

    b) usually produce high spin complexes and small crystal field splittings.

    c) cannot form low spin complexes.

    d) usually produce low spin complexes and small crystal field splittings.

13. Which one of the following complexes can exhibit geometrical isomerism?

    a) $[Pt(NH_3)_2Cl_2]$ (square planar) b) $[Zn(NH_3)_2Cl_2]$ (tetrahedral)

    c) $[Cu(CN)_2]^-$ (linear) d) $[Cu(NH_3)_4]^{2+}$ (square planar)

14. Which one of the following complexe can exhibit *cis* isomer?

    a) $[Pt(NH_3)_2Cl_2]$ b) $[PtCl_4]$ c) $[Cu(Cl)_2]^-$ d) $[Pt(NH_3)_4]^{2+}$

15. Which one of the following complexe can exhibit trans isomer?

    a) $[Pt(NH_3)_2Cl_2]$ b) $[PtCl_4]$ c) $[Cu(Cl)_2]^-$ d) $[Pt(NH_3)_4]^{2+}$

16. Organometallic chemistry is a branch of chemistry deals with compounds possessing…………

    a) Carbon-Carbon Bond b) Metal-Metal Bond

    c) Metal-Carbon Bond d) Metal-Boron Bond

17. The multiple bond character of the metal-carbon bond in metal carbonyls is du to the presence of …………

    a) Carbon-Carbon Bond b) Metal-Metal Bond

    c) Hydrogen Bonding d) Back bonding

18. Atomic states are well described by the term symbols of the form …………

    a) $^{J+1}L_{2S+1}$ b) $^{J}L_{2S+1}$ c) $^{2S+1}L_J$ d) $^{2S}L_J$

19. The ground state term symbol for Fluorine (*2p⁵* system) is

    a) $^2P_{3/2}$ b) $^2P_{5/2}$ c) $^3P_{3/2}$ d) $^2S_{3/2}$

20. The oxidation state of Ferrocene ($Fe(C_5H_5)_2$) is

    a) 3+ b) 0 c) 2+ d) 4+

PART-B

Answer all the questions **5 X 5 = 25**

21. (a) State and explain Fajan's rule with an example. **(OR)**

(b) Describe radius ratio rule.

22. (a) Explain hybridization and geometry of NH_3. **(OR)**

(b) What are the failures of VBT.

23. (a) State and explain John Teller distortion with an example. **(OR)**

(b) Describe splitting of d-ordbitals in square planar geometry.

24. (a) Write a note on trans effect with an example. **(OR)**

(b) Discuss hydrogenation of alkene using wilkinson's catalyst.

25. (a) (i) What is ground term for d^2 system.

(ii) Give selection rule for electronic spectra. **(OR)**

(b) Draw and explain Orgel diagram of d^3 system.

PART – C

Answer any three of the questions 3X 10 = 30

26. Write note on (i) Lattice energy (ii) Born-Haber cycle.

27. Explain LCAO method for molecular orbitals in O_2.

28. Illustrate splitting of d-orbitals in octahedral and Tetrahedral geometry.

29. (i) Differentiate thermodynamic and kinetic stability.

(ii) Write notes on stability constant.

30. (i) Derive term symbol for d^4 system.

(ii) Explain charge transfer spectra with an example.

18P2CHE02

VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN
(AUTONOMOUS)
DEPARTMENT OF CHEMISTRY
M.Sc DEGREE EXAMINATION –II SEMESTER
MODEL QUESTION- ELECTROCHEMISTRY AND PHOTOCHEMISTRY

Time:3 Hrs **Max Marks: 75**

PART-A

Answer all the questions. **20 X 1 =20**

1. How can an electric double layer be formed around the solid particles of suspensions?

a) The particles are charged as a matter of course

b) As a result of the attractive forces acting between the particles

c) Ions are adsorbed on the surface

d) As a result of the adsorption of apolar substances

2. The reverse of electro-osmosis

a) zeta potential b) Osmosis c) iso-electric point d) streaming potential

3. In this equation $V_w = k \ln (C_g/C_0) + V_e$, here V_e is

a) electrophoretic mobility b) zeta potential

c) polarization d) Poisson's velocity

4. Which method is not a sedimentation method?

a) Ultracentrifugation b) Sedimentation c) Gel filtration

d) Centrifugation

5. Pick out the ionic strength for a solution of 0.10 M NaCl.

a) 0.2 M b) 0.5 M c) 0.1 M d) 0.25 M

6. As the ionic strength, μ increases the activity coefficient (ϒ)

a) increases b) decreases c) neutral d) none of all

7. Debye-Hückel theory is valid only

a) High concentration b) High concentration

c) low concentration d) non-ideal solution

8. Which ion is kinetically inert?

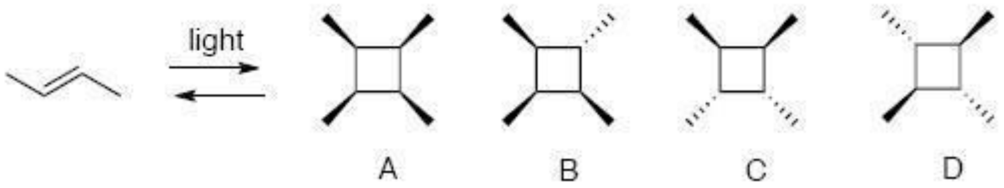
a) Cr^{2+} b) Co^{3+} c) Co^{2+} d) Fe^{3+}

9. A photochemical reaction is

a) catalyzed by light b) initiated by light c) accompanied with emission of light

d) used to convert heat energy into light

10. Photochemical reaction of trans-2-butene with itself will produce which of the following products?



a) A and B b) C and D c) A and C d) B and D

11. Fluorescence is a slow process on

a) 10^{-9} to 10^{-7} sec b) 10^{-8} to 10^{-6} sec c) 10^{-3} to 10^{-8} sec d) 10^{-9} to 10^{-1} sec

12. Photochemical reactions are independent of

a) Pressure b) Temperature c) Free energy d) all the above

13. A photochemically-induced electrocyclic reaction involves which of a molecule's molecular orbitals?

a) HOMO^{-1} b) HOMO c) LUMO d) LUMO^{+1}

14. Which of the following reactions converts an unsaturated ether to a γ,δ-unsaturated carbonyl compound?

a) Cope rearrangement b) Claisen rearrangement

c) Photochemical [2+2] reaction d) Diels-Alder reaction

15. The transition in intersystem crossing is

a) $S_1 \rightarrow T_1$ b) $T_1 \rightarrow S_0$ c) $S_0 \rightarrow S_n$ d) $T_1 \rightarrow S_0$

16. Examples for Non-Equilibration of Excited Rotamers is

a) 1,3-cyclohexadiene b) hexane c) Fluvene d) cyclohexane

17. Example for atomic photosensitizers

a) Mercury b) Nitrogen c) Carbon monoxide d) Nickel

18. Emission occurs at ordinary temperature, the emitted radiation is also known a

a) Black light b) Blue light c) Cold light d) White light

19. The wavelength of X-ray is

a) Below 0.1 nm b) 10 –200 nm c) 360–800 nm d) 0.1–10 nm

20. Systemic name for PLA is

a) 2-hydroxypropanoic acid b) hydroxy ester c) polyesters

d) polyamides

PART-B

Answer all the questions 5x5=25

21. (a) Discuss the Chemical cells with and without transferences. **(OR)**
    (b) Explain the Streaming and Sedimentation potentials.
22. (a) What do you mean by Debye-Falkenhagen and Wein effects. **(OR)**
    (b) Explain the Quantitative and qualitative verification of Debye- Huckel limiting law.
23. (a) Explain the construction of Jablonski diagram. **(OR)**
    (b) Write a note on Frank- Condon principle and its selection rules.
24. (a) Explain the formation of peroxy compoounds. **(OR)**
    (b) Write a note on photo – fries rearrangement.
25. (a) How will you explain the photosensitisers and chemistry of vision. **(OR)**
    (b) Explain photodegredation and photo stabilisation.

PART-C

Answer any three of the questions. 3x10=30

26. Explain the theories of double layer.
27. Derive the Debye - Huckel theory of inter-ionic attraction and ionic atmosphere.
28. What is mean by photochemical reactions and explain photo reduction and oxidation, Photodimerization.
29. Explain the Norish type I and norish type II with examples.
30. Explain theultraviolet screening agents , optical bleach and photochronism.

Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	**18P3CH06**	**Title**	**Batch**	2019-21
		Core VI – Organic Chemistry-III	**Semester**	III
Hrs/Week	5		**Credits**	05

Course Objective

To enable student to learn about the chemistry of natural products.

To learn the concepts of pericyclic reactions.

To learn the relation between the structure and physiological properties of chemicals.

To learn the basic principles and various method of green synthesis in organic chemistry.

Course Outcomes (CO)

K1	CO1	Students can learn about the chemical properties and structure of organic compounds like terpenoids, alkaloids, steroids and flavones etc derived from plant materials.
K2	CO2	Students can understand isolation, characterisation and laboratory synthesis of natural products.
K3	CO3	Student can know the concept of HOMO and LUMO, and their influence in bond formation.
K4	CO4	Students study the nature of double bonded compounds and the possible isomer arrived upon their rearrangement.
K5	CO5	Knowledge of student will be enriched with green chemistry and various types of eco-friendly reactions could be conducted on their own.

UNIT – I Terpenoids and Alkaloids (15 Hours)

Terpenoids: Clasification-General structural elucidation. Structural elucidation and synthesis of α-Pinene, Camphor, Zingiberene and Juvenile hormone.

Alkaloids: Clasification-General structural elucidation. Structural elucidation and synthesis of Reserpine, Morphine, Quinine, Cinchonine and Papaverine.

SELF STUDY: Biological role of alkaloids in human activity.

PRACTICAL WORK: Determination of functional group in Terpenoids and Alkaloids

UNIT – II Steroids, Flavones and Vitamins (15 Hours)

Steroids: Classification – structural elucidation and synthesis of Cholesterol, Estrone, progesterone, Stigmasterol.

Flavones: Introduction- Baker-Venkataraman rearrangement-Kostanecki synthesis of flavones-Flavonol; Synthesis of Quercetin-Isoflavones; Daidzein.

Vitamins: Physiological importance, Structural elucidation of B_6, B_{12}, and K.

SELF STUDY: Physiological importance of steroids and flavones

PRACTICAL WORK: Extraction and estimation of vitamins.

UNIT – III Pericyclic reactions (15 Hours)

Concerted reactions-Stereochemistry-orbital symmetry and correlation diagram – Frontier Molecular Orbital approach – Woodward and Hoffman rules – Electrocyclic reactions – cycloaddition- selection rule-sigmatropic rearrangements- selection rules with simple examples – 1,3 and 1,5 –hydrogen shifts – Cope and Claisen rearrangement.

SELF STUDY: Types of pericyclic reactions, Basic requirements of pericyclic reactions.

PRACTICAL WORK: Prepare a chart for Woodward-Hoffman rules.

UNIT – IV Anthocyanins, Purines and Nucleic acids (15 Hours)

Introduction to anthocyanins – Synthesis of anthocyanins. Structure and biological applications - Uric acid, Purine derivatives and Xanthine bases.

Nucleic acids – Synthesis of Nucleosides (Purines-Adenine, Guanine; Pyrimidines-Uracil, Thymine, Cytosine). Synthesis of Nucleotides – adenosine-5'-phosphate.

SELF STUDY: Natural source of anthocyanins.

PRACTICAL WORK: Chromatographic studies of nucleic acids

UNIT – V Green synthesis (15 Hours)

Principles of Green chemistry, Synthesis in water-Pericyclic reaction-Wittig-Horner reaction, Strecker synthesis-Synthesis in super critical Carbondioxide-Freidal crafts reaction, Hydroformylation reaction. Types and preparation of ionic liquids, synthesis using ionic liquids-Claisen-Schmidt Condensation-Polymer supported green reagent-PNBS, Synthesis using PTC-mechanism, types, advantages and applications of PTC, Microwave induced Green synthesis-Comparison of reactions in water and organic solvents.

SELF STUDY: Basic principles of microwave, sonochemical synthesis.

PRACTICAL WORK: Carry out a green synthesis with water and solid supported reagents.

CONTENT BEYOND THE SYLLABUS

6. Classification and medicinal applications of terpenoids and alkaloids.
7. Synthetic route of a molecule of your choice.
8. Elucidate structure of a molecule of your choice.
9. Influence of 1,3 and 1,5 –hydrogen shifts in sigmatropic rearrangements.
10. Identify green reactions and their advantages.

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TEXT BOOKS

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Mapping

PSO CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	VS	S	S	W	S	VW
CO2	S	VS	S	S	VS	VS
CO3	VS	W	S	VW	S	S
CO4	S	VS	VS	W	W	VW
CO5	S	VS	S	VW	W	S

VS-Very strong; S-Strong; W-Weak; VW-Very weak

Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	**18P3CH07**	**Title**	**Batch**	2019-21
		Core VII – Inorganic Chemistry-III	**Semester**	III
Hrs/Week	5		**Credits**	05

Course Objective

3. To gain knowledge about non aqueous solvents, cages ,chains and clusters.
4. To learn elaborately in the field of solid state and bio-inorganic chemistry.
5. To understand the working and application of various analytical tools to deduce crystal structure of solids.

Course Outcomes (CO)

K1	CO1	Students have the knowledge of application and properties of non aqueous solvents and formation of liquid and gaseous molecules.
K2	CO2	Students can able understand the commercial application of inorganic molecule such as silicates , Zeolites, Ultramarine and silicones
K3	CO3	Students are enable to understand the basic of crystal structure, application of the analytical tools like XRD, AAS and PES tools in elucidating three dimensional structure of the inorganic molecules.
K4	CO4	Students can know the importance of biologically important materials in our body.
K5	CO5	Students will have enriched knowledge on porphyrin and other bioinorganic molecules

Unit – I: Non-aqueous solvents (15 Hours)

Classification of non aqueous solvents- Solute-Solvent interactions- Reactions in liquid ammonia- metals in liquid ammonia- Reactions in anhydrous sulphuric acid, liquid sulphur dioxide, liquid HF and liquid, dinitrogen tetroxide. Distribution law, extraction process, liquid - liquid extraction, extractants, factors affecting extraction, technique for solvent extraction, quantitative treatment of solvent extraction equilibria, Classification of solvent extraction systems, Transition of a substance from an aqueous phase.

SELF STUDY: Influence of Non-ionizing non-aqueous solvents on acids

PRACTICAL WORK: Comparisons of acidity and basicity between solvents

Unit – II: Inorganic chains, rings, cages and clusters (15 Hours)

Silicate minerals – ortho-, pyro-, and meta-silicates – pyroxene, amphiboles – two-dimensional silicates – talc, mica and three dimensional aluminosilicates, zeolites. Silicones-preparation, properties and uses - Iso and hetero-polyacids - Structures of $[TeMo_6O_{24}]^{6-}$ and $[Mo_7O_{24}]^{6-}$ ions and $[PMo_{12}O_{40}]^{3-}$ ion – Polymeric sulphur nitride – borazines, phosphonitrilic compounds-trimers and tetramers - homocyclic inorganic ring systems – Concept of multi-centered bond – structure of B_2H_6, B_4H_{10}, $[B_{12}H_{12}]^{2-}$, B_6H_{10}, Wade's rules, closo, nido, arachno boranes and carboranes and "styx" code.

SELF STUDY: Identification of boranes and carboranes using Wade-Mingo's rule.

PRACTICAL WORK: Application of sulphur nitrides in soalr cells and LED.

Unit – III: Solid State Chemistry (15 Hours)

Space lattice - unit cell- crystal systems- elements of symmetry- space groups-Miller indices- crystal analysis- XRD - rotating crystal method- powder method - packing of atoms and ions in solids- Electrical properties of solids – Band theory, semiconductors, super conductors, theory of super conductivity – defects in solids - solid state electrolytes; magnetic properties of solids – dia, para, ferro, antiferro and ferrimagnetism; hysterisis; Optical properties – solid – state lasers and Inorganic phosphors. Reactions in solid state and phase transitions – diffusion coefficient, diffusion mechanism, vacancy and interstitial diffusions, formation of spinels and inverse spinels; solid solutions.

SELF STUDY: Discuss the types and structure of Bravis Lattices

PRACTICAL WORK: Identify spinels and inverse spinels using CFSE.

Unit – IV: Atomic absorption, emission spectroscopy and Crystal Studies (15 Hours)

Atomic absorption spectroscopy and flame emission spectroscopy: Basic principles - flame characteristics - atomizers and burners- interference instrumentation and applications of AAS and FES. PES –theory of XPS, UPES-evaluation of ionization potential-chemical identification of elements – ESCA - Koopmann's theorem-chemical shift - UPES, XPS of N_2, O_2, and HCl-evaluation of vibration constants from UPES-spin orbit coupling.

SELF STUDY: Comparison between absorption and emission spectroscopy

PRACTICAL WORK: Application of AAS in food Industry

UNIT – V: Bio-inorganic Chemistry (15 Hours)

Porphyrin ring system - Metalloporphyrins - Haemoglobin and Myoglobin-structures and work functions - other oxygen carriers - Cytochromes: Structure and work functions in respiration - Chlorophyll, structure - photo synthetic sequence - Sulphur proteins - (Non - Haemo iron protein) - Copper oxidizes - Blue copper proteins - Carboxyl peptidase A: Structure, function - Carbonic anhydrase: Inhibition and Poisoning - Corrin ring system - Vitamin B_{12}, In vivo and in vitro nitrogen fixation - Molecular mechanism of ion transport across the membrane - Na and K ion pumps-Chelate therapy-cis-platin.

SELF STUDY: Compare Haemoglobin and Myoglobin.

PRACTICAL WORK: Chlorophyll separation from different types of plants

CONTENT BEYOND THE SYLLABUS

6. Nonaqueous solvent as a medium to conduct organic reactions.

7. Application of silicates, silicones and zeolites ,felspar,aluminosilicates in the field of medicine.
8. Minerals present in the human body.
9. Applications of different MEMBRANES USED IN AAS.
10. Solid state chemistry in human welfare.

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Mapping

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	S	VS	VS	VW	W	VS
CO2	S	VW	VS	S	VS	VW
CO3	S	W	VS	W	VS	VS
CO4	VS	VS	VS	W	VW	W
CO5	VS	VS	S	W	W	VS

VS-Very strong; S-Strong; W-Weak; VW-Very weak

Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	**18P3CH08**	**Title**	**Batch**	2019-21
		Core VIII- Physical Chemistry - II	**Semester**	III
Hrs/Week	5		**Credits**	05

Course Objective

3. To impart knowledge in the field of Quantum chemistry, Thermodynamics and Spectroscopy.

4. To make the students to understand the principles of vibrational and rotational spectroscopy.
5.

Course Outcomes (CO)

K1	CO1	Students will be able to identify wave functions using operators and recognize functions and values.
K2	CO2	Students will learn to perturbation and variation.
K3	CO3	Students can learn the concept of chemical potential, fugacity of gases, Activity and activity coefficient
K4	CO4	Students will learn about Electromagnetic radiation, Rotational, vibrational, and electronic transitions in molecules.
K5	CO5	Students can understand the importance, applications and basic aspects of Vibrational Spectroscopy.

Unit I: Quantum Chemistry-I **(15Hours)**

Quantum theory: Inadequacy of classical mechanics - Black body radiation - Born's interpretation of wave function - Operators: Commutator - Linear operators and Hermitian operator- Eigen functions and Eigen values - Hamiltonian operator - Postulates of quantum mechanics - Schrodinger equation and its solution to the problem to a particle moving in one dimensional box and three dimensional box - Rigid rotor - Simple harmonic oscillator - Schrodinger equation for the H-atom.

SELF STUDY: Photoelectric effect, Dual character of electron.

PRACTICAL WORK: Prepare a schematic representation of SHO and rigid rotor.

UNIT-II: Quantum Chemistry-II **(15 Hours)**

Approximation methods : Perturbation and variation methods - application to ground state energy of hydrogen and helium atom - self consistent field approximation - Hartree and Hartree-Fock's SCF method - VB and MO theory-application to hydrogen molecule – Huckel's MO theory – Application to ethylene and benzene.

SELF STUDY: Stark effect on the first excited state of hydrogen atom.

PRACTICAL WORK: Prepare a chart to compare Huckel model of ethylene and benzene.

Unit-III: Thermodynamics-I **(15 Hours)**

Thermodynamics of non-ideal systems - Concept of chemical potential - Gibbs-Duhem equation - Variation of chemical potential with temperature and pressure - Concept of fugacity of gases - Determination by graphical method and from equation of state - Variation of fugacity with temperature and pressure - Fugacity coefficient - Activity and activity coefficient - Variation of activity of a gas with pressure and temperature. Determination of solvent activity by vapour pressure method and Cryoscopic method.

SELF STUDY: Relation between fugacity and activity coefficient.

PRACTICAL WORK: Experimental determination of solvent activity by cryoscopic method.

Unit-IV: Microwave spectra **(15 Hours)**

Introduction: Electromagnetic radiation, Interaction of light with matter, mechanism of absorption & emission of radiation. Rotational, vibrational, and electronic transitions in molecules; regions and representation of spectra.

Micro wave Spectroscopy: Diatomic molecules as rigid rotors: rotational energy levels, intensity of spectral lines, selection rules, effect of isotopic substitution. Diatomic molecules as non-rigid rotors. Rotational spectra of polyatomic molecules.

SELF STUDY: Classical and Quantum mechanics of Micro wave Rotational Spectroscopy.

PRACTICAL WORK: Prepare a model to show the rotational modes in microwave spectra.

Unit-V: Vibrational Spectra **(15 Hours)**

Vibrational Spectroscopy: Vibrating diatomic molecule: energy of diatomic molecules as simple harmonic and Unharmonic oscillator - energy levels, vibrational transitions, selection rules; Diatomic vibrating rotator: Born-Oppenheimer approximation, vibration-rotational spectra, selection rules; P, Q, R branches. Vibrations of polyatomic molecules: fundamental vibrations and its symmetry, normal modes of vibration, overtones and combination of bands.

Raman Effect: Rayleigh and Raman scattering, Stokes and anti-Stokes lines, molecular polarizability, Raman selection rules. Raman spectra: rotational Raman spectra-linear molecules, symmetric top and spherical top molecules; vibrational Raman spectra-symmetry and Raman active vibrations, rule of mutual exclusion.

SELF STUDY: Instrumentation of Raman spectroscopy

PRACTICAL WORK: Synthesize and study the vibrational spectra of any one molecule.

CONTENT BEYOND THE SYLLABUS

6. Superiority of Quantum chemistry over classical mechanics.
7. Approximation methods in arriving hybridization of smaller molecules.
8. Non-ideal systems in pressure and temperature dependant reactions.
9. Electromagnetic radiations- application and associated physical events..
10. Complementary role of Raman spectra to IR spectra.

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Mapping

PSO CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	S	S	VS	VS	W	VS
CO2	S	VS	VW	W	VW	VS
CO3	S	VW	VS	VS	W	VS
CO4	VS	VS	W	VW	S	S
CO5	VS	VS	S	W	W	VS

VS-Very strong; S-Strong; W-Weak; VW-Very weak

Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	18P3CHED01	**Title**	**Batch**	2019-21
		Elective Paper - III	**Semester**	III
Hrs/Week	5	**APPLIED POLYMER CHEMISTRY**	**Credits**	04

Course Objective

1. To impart the knowledge in the field of polymer chemistry.
2. To acquire knowledge in the preparation methods of addition polymers.
3. To impart knowledge in the preparation of syndiotactic, atactic and isotactic polymers using Zeiler-Natta catalyst.
4. To impart understanding in the field of processing of polymers.
5. To explore the applications of various synthetic polymers.

Course Outcomes (CO)

K1	CO1	Students enable to understand various methods of polymer preparation.
K2	CO2	Acquire knowledge about types of polymers and processing techniques.
K3	CO3	Students know Molecular weight determination of polymers.
K4	CO4	Students will analyze the various processing of polymers
K5	CO5	Students enable to understand importance of polymers used for commercial applications.

UNIT I: Basic Concepts (15 Hours)

Monomers, degree of polymerization, Linear, branched and network Polymers. Addition polymerization: Mechanism of Free radical, cationic and anionic polymerization. Condensation Polymerization in homogeneous and heterogeneous systems.

SELF STUDY: Classification of polymers

PRACTICAL WORK: Synthesis of Polyethylene using Radical polymerisation

UNIT II: Co-ordination and co-polymerization (15 Hours)

Kinetics, mono and bimetallic mechanism of co-ordination polymers. Advantages of Zeigler-Natta catalyst. Co-polymerization: Block and graft co-polymers, kinetics of copolymerization. Types of co-polymerization. Reactivity ratio. Cross-linked polymers and their applications.

SELF STUDY: Study the types of coordination polymerization

PRACTICAL WORK: Calculation of reactivity ratio using Mayo–Lewis equation

UNIT III: Molecular Weight and Properties (15 Hours)

Polydispersion–average molecular weight concept, number, weight and viscosity average molecular weights. Measurement of molecular weights- Viscosity, light scattering, osmotic and ultracentrifugation methods. Polymer structure and physical properties–crystalline melting point T_m. Glass transition temperature (T_g), Determination of T_g. Relationship between T_m and T_g.

SELF STUDY: Study of tensile Strength and Elongation property of polymers

PRACTICAL WORK: Determination of Glass transition temperature for various polymers

UNIT IV: Polymer Processing (15 Hours)

Plastics, elastomers and fibres. Compounding, processing techniques: calendering, die casting, rotational casting, film casting, injection moulding, blow moulding extrusion, moulding, thermoforming, foaming, reinforcing and fibre spinning.

SELF STUDY: Compounding technique by extrusion method

PRACTICAL WORK: List out the major problems involved in Polymer Processing

UNIT V: Preparation and applications of Commercial Polymers (15 Hours)

Polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins and silicone polymers. Functional polymers, Fire retarding polymers and electrically conducting polymers. Biomedical polymers–contact lens, dental polymers, artificial heart, kidney, skin and blood cells.

SELF STUDY: Discuss the preparation and application of polystyrene

PRACTICAL WORK: Polymers in Road construction

CONTENT BEYOND THE SYLLABUS

5. Cross linked polymers and their commercial applications.
6. Green polymer processing techniques.
7. Biodegradable polymers in the place of artificial polymers.

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Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	VS	S	VS	S	VW	VS
CO2	W	VW	VS	VW	W	VW
CO3	VS	S	VW	VS	VS	W
CO4	S	S	W	VS	S	S

CO5	W	W	VS	W	S	VS

VS-Very strong; S-Strong; W-Weak; VW-Very weak

Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	**18P4CH09**	**Title**	**Batch**	2019-21
		Core IX – **PHYSICAL CHEMISTRY-III**	**Semester**	IV
Hrs/Week	5		**Credits**	05

Course Objective

5. To enable the students to acquire knowledge on statistical thermodynamics.
6. To understand the difference between classical and statistical thermodynamics.
7. To acquire knowledge in the field of UV-Vis spectroscopy and its application to organic molecules.
8. To impart knowledge in the field of various spectroscopic techniques like NMR, NQR, MASS, and ESR and their applications in the characterization of molecules.

Course Outcomes (CO)

K1	CO1	Students will learn the Objectives and various functions of Statistical thermodynamics.
K2	CO2	Students acquire deep knowledge about the concept of non equilibrium and applications
K3	CO3	Students will learn about the theory of UV-spectroscopy, Fluorescence Spectroscopy and its applications
K4	CO4	Students will analyze theory and applications of NMR and EPR spectroscopy
K5	CO5	Students will evaluate the molecular weight of the organic compounds

Unit-I: Statistical Thermodynamics (15 Hours)

Objectives of Statistical thermodynamics – concept of thermodynamically and mathematical probabilities – Distribution of distinguishable and non – distinguishable particles. Maxwell – Boltzmann, Bose – Einstein and Fermi – Dirac statistics Law – comparison and its applications. Partition Function – evolution of Translational, Vibrational, Rotational and Electronic partition Functions – Thermodynamic Functions in terms of partition Function – Statistical expression for equilibrium constant – Calculation of Equilibrium constant from partition Function. Heat capacities of solids - Einstein's and Debye's theories of heat capacities of solids.

SELF STUDY: Fundamentals of classical and statistical thermodynamics.

PRACTICAL WORK: Statistical Thermodynamics of Iodine Sublimation

Unit-II: Non-Equilibrium Thermodynamics (15 Hours)

Non-Equilibrium - its postulates- Entropy production-Entropy production in heat flow and matter flow. Forces and fluxes-Flows and coupled flows-Linear laws- Phenomenological law-Onsager reciprocal relation-Proof by Microscopic reversibility-Verification by Electro-kinetic phenomenon-Diffusion. Non-Equilibrium stationary states-Applications of non-equilibrium thermodynamics.

SELF STUDY: Flow of heat in a matter.

PRACTICAL WORK: Study of non equilibrium materials using diffusion phenomena.

Unit-III: UV and fluorescence Spectroscopy (15 Hours)

UV-spectroscopy: Theory - Instrumentation-Beer-Lamberts Law - bands in UV-VIS spectrum - Possible electronic transitions - Types of electronic transitions based on selection rules - Characteristic absorption (λmax and εmax) 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 – applications.

Fluorescence Spectroscopy: Primciples, Instrumentation and applications.

SELF STUDY: Woodward-Fieser rules for calculating absorption maximum for Diene and Triene

PRACTICAL WORK: Calculate the absorption maximum for 2,4 hexadiene and 2,3 dimethylene bicyclo [2,2,1] heptanes.

Unit-IV: NMR and ESR Spectroscopy (15 Hours)

NMR Spectra: Theory of nuclear resonance - Instrumentation - Chemical shift - Factors influencing chemical shift - Shielding and deshielding mechanisms - Spin-spin coupling - Coupling constant - Nuclear overhauser effect - Applications of NMR spectra to simple organic molecules - Introduction to13C NMR, 19F NMR, 31P NMR.

ESR Spectroscopy: Theory - derivative curves - ‘g’ values - Hyperfine splitting - Isotropic and anisotropic systems - Applications of ESR.

SELF STUDY: Study the PMR spectra of the following compounds: Benzene,Toluene,Ethyl benzene,ISopropylbromideAcetaldehyde,Acetic acid,Acetophenone,Methylpropionate

PRACTICAL WORK: Determine the structure of an organic molecule using NMR

Unit-V: Mass and Mossbauer Spectroscopy (15 Hours)

Mass Spectroscopy: Theory - Instrumentation - Types of ions: Molecular ion - Fragment ion rearrangement ion - Metastable ion - odd & even ions - Molecular ion peak - Base peak - Metastable ion peak - Determination of molecular formula - Nitrogen rule and ring rule - Isotopic abundance analysis - Fragmentation process: Retro Diels-Alder rearrangement - Mclattery rearrangement - Double bond and ring equivalence - Fragmentation of organic compounds with respect to their structural determination (alcohol, hydrocarbon, carbonyl compounds and nitro compounds).

Mossbauer Spectroscopy: Line width - Isomer shift - Quadrupole interactions - Magnetic interactions - Mossbauer emission spectroscopy - Structural elucidation of iron and tin complexes.

SELF STUDY: Basic principle of Mass and Mossbauer spectroscopy

PRACTICAL WORK: Prepare a chart on Fragmentation pattern any two organic molecules.

CONTENT BEYOND THE SYLLABUS

1.Application of distribution law and approximations

2.Classical and Statistical thermodynamics advantages.

3.Application of spectroscopic techniques.

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Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	VS	VS	S	S	VS	VS
CO2	VS	VW	VS	VW	S	W
CO3	S	VS	W	VS	VS	VS
CO4	S	S	VS	VS	W	S
CO5	VW	VW	VW	S	S	VW

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Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	18P4CHE03	**Title**	**Batch**	2019-21
		Elective IV- **ENVIRONMENTAL CHEMISTRY**	**Semester**	IV
Hrs/Week	5		**Credits**	04

Course Objective

1. To impart knowledge in the field of environment and pollution.
2. To acquire knowledge on the structure of atmosphere.
3. To impart knowledge on water quality and water treatment.
4. To impart knowledge in the field of industrial, agricultural pollutants and waste management.

Course Outcomes (CO)

K1	CO1	Students will acquire sound knowledge of environmental chemistry
K2	CO2	Students learn the importance of water management
K3	CO3	Students will acquire knowledge about pollution from industries
K4	CO4	Students will acquire knowledge about pollution from agricultural wastes
K5	CO5	Students will evaluate the waste management

UNIT -I : FUNDAMENTALS OF ENVIRONMENTAL CHEMISTRY (15 Hours)

Concept of environmental chemistry, Composition of atmosphere, vertical temperature and vertical structure of the atmosphere, Hydrological cycle, carbon and nitrogen cycle, Environmental pollution, air, water and soil pollution. Prevention and control of pollutions. Biogeochemical cycles in environment, Biological control of chemical factors in the environment.

SELF STUDY: Discuss the Noise pollution and its effect

PRACTICAL WORK: Marine pollution-Case study

UNIT- II : WATER CHEMISTRY (15 Hours)

Characteristics of water, Quality of natural water, quality requirements of portable water, organic, humic and colloidal material in water, chemical composition of water bodies, Commercial water purification method- reverse osmosis method-disinfection of water-purification method of water for industrial purpose (lime-soda process, ion exchange process, zeolite process). Water pollution and its environmental impact, eutrophication, concept of TDS, DO, BOD, COD.

SELF STUDY: Electrodialysis method

PRACTICAL WORK: Prepare a chart on International standards for Drinking water

UNIT -III : POLLUTANTS FROM INDUSTRY (15 Hours)

Polymers and Plastics: – The classification – The characteristics – Environmental Implications of polymers and plastics – abatement procedures for polymers and plastics pollution.

Asbestos: Structural characteristics of Asbestos – applications of asbestos – sources of asbestos in the environment – analysis of asbestos – effects of asbestos pollution – Mitigation of asbestos pollution.

Polychlorinated Biphenyls: The need – Fate of poly chlorinated Biphenyls in the Environment – Environmental Implications of Polychlorinated Biphenyls – Abatement procedures for poly chlorinated Biphenyls pollution.

SELF STUDY: Study on pollutants from cement Industry

PRACTICAL WORK: Tabulate the health effect of various industries near Thiruchengode

UNIT- IV : POLLUTANTS FROM AGRICULTURE (15 Hours)

Fertilizers: The classification – Environmental implications of fertilizers – Abatement procedures for fertilizers pollution – Eutrophication.

Insecticides: The classification – The characteristics –Environmental implications of insecticides – Abatement procedures for insecticides pollution – Bhopal Episode.

Fungicides and Herbicides: The need – The classification – The characteristics – Environmental Implications of Fungicides and Herbicides – Abatement procedures for fungicides and Herbicides pollution.

SELF STUDY: Classification and characteristics of pesticides

PRACTICAL WORK: Soil testing analysis in our college

UNIT- V : WASTE MANAGEMENT AND RECYCLING (15 Hours)

Waste management – Land filling – Incineration – Disposal of medicinal waste – New technique to treat industrial and farm effluents – Reduce, reuse and recycle – Wealth from waste (recycling) – Recycling technique – Utilizing agricultural waste – Waste into energy – Municipal waste into road making – Electricity from tannery waste – Plastic recycling techniques – Waste water and its treatment(recycling of sewage) – Removal of hazardous wastes from contaminated metals.

SELF STUDY: Disposal of solid waste by Digestion and Dumping

PRACTICAL WORK: Qualitative and quantitative analysis of waste water from our Institution

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1. Sharma and Kaur, Environmental Chemistry, Krishna Publishers, New Delhi, 2000.
2. Dara, S.S., Environmental Pollution and Control, S.Chand & Co., New Delhi, First Edition, 1993.
3. S.E Manahan, Environmental Chemistry, Lewis Publishers, London, 2001.
4. S.K. Banerji, Environmental Chemistry, Prentice Hall of India, New Delhi, 2003.
5. B.K.Sharma, Environmental Chemistry, Goel publishing house, Meerut, Seventh Revised, 2003

CONTENT BEYOND THE SYLLABUS

1. New sources of water.
2. Water management.
3. Prevention of pollution.

ONLINE SOURCES

1. www.purdueglobal.edu/degree-programs/legal-studies/bachelor-environmental-policy-management
2. www.onlinecolleges.net/degrees/environmental-science
3. www.forbes.com/colleges/suny-college-of-environmental-science-and-forestry

Mapping

PSO CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	S	VS	VS	S	VS	VS
CO2	VS	W	S	VW	S	VS
CO3	VS	VS	VS	S	VW	W
CO4	VW	VW	W	VS	W	S
CO5	W	S	VW	VW	W	VW

VS-Very strong; S-Strong; W-Weak; VW-Very weak

Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	18P4CHP04	**Title**	**Batch**	2019-21
		CORE PRACTICAL – IV **ORGANIC CHEMISTRY PRACTICAL– II**	**Semester**	IV
Hrs/Week	5		**Credits**	04

Course Objective

1. The objective of this lab is to provide hands-on training to estimate organic compounds.
2. It also gives an idea to sort out a suitable method to estimate organic compounds of their interest.
3. To train the students to conduct two stage preparations.

Course Outcomes (CO)

K1	CO1	Students can able to estimate quantitatively the give organic compound.
K2	CO2	Students can able to design a synthesis of new compound.
K3	CO3	Students can able to purify the synthesized compound.
K4	CO4	Students can able to propose the mechanism of chemical reactions
K5	CO5	Students will able to carry out their research in future.

(a) Organic Estimation:

3. Estimation of phenol
4. Estimation of aniline
5. Estimation of methyl ketone
6. Estimation of glucose
7. Estimation of Ascorbic acid
8. Determination of saponification value of an oil

(b) Two stage organic preparations and Rearrangements:

1. sym-Tribromobenzene from aniline (Bromination + Hydrolysis)
2. p-nitroaniline from acetanilide (Nitration + Hydrolysis)
3. Benzanilide from benzophenone (Rearrangement)
4. m-nitroaniline from nitrobenzene (Nitration + Reduction)
5. p-Bromoaniline from acetanilide (Bromination + Hydrolysis)

CONTENT BEYOND THE SYLLABUS

3. Developing a novel method to estimate a compound with medicinal value.

Develop a novel method to synthesis a compound.

REFERENCES

1. Dr. N.S Gnanapragasam , Organic chemistry Lab manual.
2. Raj .K. Bansal, Laboratory Manual of Organic chemistry, 3rd Edition, New Age Internal Publication .

3. B.S. Furniss, A.J.Hannaford, P.W.D Smith and A.R. Tatchell, Vogel's Practical Organic chemistry, 5th Edition. ELBS

ONLINE SOURCES

1. http://wwwchem.uwimona.edu.jm/lab_manuals/c10expt25.html
2. http://vlab.amrita.edu/?sub=2&brch=191&sim=345&cnt=1
3. http://amrita.olabs.edu.in/?sub=73&brch=8&sim=116&cnt=1

Mapping

PSO CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	S	VS	VS	S	VS	VS
CO2	W	VW	VW	W	VW	W
CO3	VS	S	VS	S	VS	VW
CO4	S	S	W	S	S	VS
CO5	VW	VW	VW	VW	VS	S

VS-Very strong; S-Strong; W-Weak; VW-Very weak

Programme code	M.Sc.,	**Programme Title**	Master of Science (Chemistry)	
Course Code	18P4CHP04	**Title**	**Batch**	2019-21
		CORE PRACTICAL – V	**Semester**	IV
Hrs/Week	5	**INORGANIC CHEMISTRY PRACTICAL– II**	**Credits**	04

Course Objective

6. To acquire training in micro scale experimental techniques.
7. To acquire knowledge on the properties of ions and their compounds.
8. To educate the students about the complex formation reaction, influence of pH, stability of complexes and application of complex formation reaction in analytical chemistry.
9. To impart knowledge about variation in the chemical behavior of elements in the same group.
10. To promote the students towards research activity and job opportunities.

Course Outcomes (CO)

K1	CO1	Students will learn how to conduct a process systematically and precisely.
K2	CO2	The qualitative analysis gives a type of mental training and develops a power of reasoning not equal to any other course in chemistry.
K3	CO3	The students will learn the nature, significance, and influence of errors and how they may best be avoided or minimized during qualitative and quantitative examination of a chemical compound.
K4	CO4	Students will able to design and synthesize new complexes
K5	CO5	Students will able to carry out their research in future.

(a) Quantitative analysis of the following mixture

1. Iron and Magnesium
2. Iron and Nickel
3. Copper and Nickel
4. Copper and Zinc

(b) Preparations of the following complexes

1. Tris(thiourea)copper(I) chloride
2. Bis(acetylacetanato) copper(II)
3. Hexamminecobalt(III) chloride
4. Sodium hexanitrocobaltate(III)
5. Potasium trioxalatoaluminate(III) trihydrate
6. Chloropentamminecobalt(III) chloride
7. Hexamminenickel(II) chloride

CONTENT BEYOND THE SYLLABUS

3. Estimate the hardness of water using EDTA.
4. Analyze the given cation using different qualitative methods.

REFERENCES

1.J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas, Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearson Education (2001).

2. V. Venkateswaran, R. Veeraswamy and A.R.Kulandaivelu, Basic Principles of Practical Chemistry, New Delhi, S.Chand & Co, (1995).

ONLINE SOURCES

4. http://lib.hku.hk/Press/9622092128.pdf
5. http://www.kvsunjuwan.com
6. http://science-blogs.ucoz.com/resources/notes/msc/pract1/CationGuide.pdf

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	S	S	VS	VS	VS	S
CO2	W	W	VW	VW	W	VW
CO3	VS	S	VS	S	S	S
CO4	S	VS	W	VW	S	S
CO5	VW	S	S	S	VS	VW

VS-Very strong; S-Strong; W-Weak; VW-Very weak

18P3CH06

VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN
(AUTONOMOUS)
DEPARTMENT OF CHEMISTRY
M.Sc. DEGREE EXAMINATION –III SEMESTER
MODEL QUESTION- ORGANIC CHEMISTRY III

Time: 3 Hrs **Max Marks: 75**

PART-A

Answer all the questions **20 X 1 = 20**

1. _____ are normally occurring nitrogen compounds that are generally obtained by plants.

a) terpenes b) alkaloids c) steroids d) none of the above

2. The term _____ includes a wide range of natural compounds from terpenes to steroids.

a) terpenoids b) flavonoids c) flavones d) flavanol

3. Predict a terpenoid from the following,

a) daidzein b) morphine c) xanthine d) zingiberene

4. When oxidized with cold dilute KMnO4 papaverine is converted into _______

a) papaverinol b) papaveroline c) papaverine d) papaverinic acid

5. Steroids are _____ derivatives that are widely present in plants and animals

a) biterpene b) triterpene c) teteracyclic triterpene d) none of the above

6. _____ is an example for sterols

a) glycosides b) sapogenins c) cholesterol d) gastogens

7. Vitamin B_{12} is also known as _____

a) niacin b) thiamine c) cyanocobalamine d) riboflavin

8. Clolesterol is a white crystalline solid, which is optically _____

a) active b) inactive c) stable d) less stable

9. The fundamental nucleus in anthocyanines is ______

a) fluoroglucinol b) benzopyrylium chloride c) phenolic acid d) none of the above

10. Anthocyanins with free OH^- groups in th 3-position are raadily _____ by $FeCl_3$

a) reduced b) hydrolyzed c) oxidized d) none of the above

11. One of the important xanthine bases, that occur naturally is _____

a) Caffeine b) guanine c) purine d) adenine

12. Combination of nucleoside with phosphoric acid yields _____

a) inosine b) ribose c) uracil d) nucleotide

13. Pericyclic reactions are highly ______

a) electrophilic b) nucleophilic c) stereospecific d) stereoselective

14. the photochemical suprafacial mode of cycloaddition is _____

a) symmetry forbidden b) thermally allowed

c) thermally forbidden d) symmetry allowed

15. Cope and Claisen rearrangements are ______

a) cycloadditions b) electrocyclic reactions

c) cyclocondensations d) sigmatropic rearrangements

16. Diels-Alder reaction is the well known example of ______

a) cycloadditions b) electrocyclic reactions

c) cyclocondensations d) sigmatropic rearrangements

17. find one of the important green chemistry principles from he following,

a) wastage b) energy framework c) Design for energy efficiency d) hazardous

18. Strecker is the reaction of an aldehyde with NH_3 and HCN yields ______

a) α-aminonitrile b) β-aminonitrile c) α-aminophenol d) β-aminophenol

19. Rearrangements of allyl aryl ethers to *o*- or *p*- allylphenols is known as _____ rearrangement

a) Fries b) Claisen c) Wolff d) Beckmann

20. ______ reactions do not involve ionic or free radical intermediates

a) addition b) substitution c) elimination d) pericyclic

PART - B

Answer all the questions 5 X 5 = 25

21. (a) What are alkaloids? Explain its classification in brief. **(OR)**

(b) Describe the following synthesis,

1) Papaverine 2) Zingiberene

22. (a) Explain about the Kostaneck synthesis of flavones. **(OR)**

(b) Describe the structural elucidation of vitamin B_{12} in brief.

23. (a) Write a detailed note on cycloaddition. **(OR)**

(b) Explain the Claisen rearrangement with mechanism.

24. (a) Describe the synthesis of anthocyanin in detail.. **(OR)**

(b) Write a short note onadenosine-5'-phosphate.

25. (a) What are pericyclic reactions? Explain it with suitable example. **(OR)**

(b) Write a detailed note on polymer supported green reagent.

PART - C

Answer any three of the questions 3 X 10 = 30

26. Explain the structural elucidation of α - pinene.

27. What are steroids? Describe the structural elucidation of estrone in detail.
28. Explain the FMO method for analyzing an electrocyclic reactions with an example.
29. Explain the structure and biological applications of anthocyanins in detail.
30. What is meant by green chemistry? Explain its principles in detail.

18P3CH07

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(Autonomous)
M.Sc. DEGREE EXAMINATION
MODEL QUESTION - INORGANIC CHEMISTRY-III

Time : 3 hrs **Maximum : 75 Marks**

SECTION A – (20x 1 = 20 marks)

Answer All the Questions

1. Which statement is incorrect?

(a) $Zn(OH)_2$ is insoluble in water (b) $Zn(NH_2)_2$ is insoluble in liquid NH_3 (c) Alkali metal salts of $[Zn(OH)_4]^{2-}$ are soluble in water(d) Alkali metal salts of $[Zn(NH_2)_4]^{2-}$ are insoluble in liquid NH_3

2. Liquid HF undergoes self ionization to give a liquid that contains:

(a) $[H_2F]^-$ (b) $[HF_2]^-$ (c) H^+ (d) F^-

3. Which of the following non-aqueous solvents has the longest liquid range?

(a) H_2SO_4 (b)N_2O_4 (c) NH_3 (d) HF

4. Protogenic solvent is

(a)Sulphuric acid (b)Hydrochloric acid (c)Nitric acid (d)all

5. Which one of these is not electrolyte?

(a) sodium chloride solution (b) acidulated water (c) sugar (d) sodium hydroxide solution

6. Which method of analysis does not classify variables as dependent or independent?

(a) regression analysis (b) discriminant analysis(c) analysis of variance (d) cluster analysis

7. In cluster sampling, elements of selected clusters are classified as

(a) elementary units (b) primary units (c) secondary units (d) proportional units

8. Which one of the following atoms does NOT have an octet?

(a) chloride ion (b) neutral N atom in amines (c) positive N in ammonium ions (d) neutral B in boranes.

9. The smallest repetitive unit of the crystal structure is known as___________

(a) atoms (b) compound (c) unit cell (d) Lattice

10. Crystals in which the number of the combinations of the symmetric molecule is limited to 32 is known as ________

(a) Crystallographic unit cell (b) Crystallographic point groups (c) Crystallographic crystals (d) crystallographic atoms.

11. The point coordinates of the vertex just opposite to the origin are

(a) 0 0 0 (b) 0 0 1 (c) 0 1 1 (d) 1 1 1

12. Example for dia-magnetic materials

(a) super conductors (b) alkali metals (c) transition metals (d) Ferrites

13. Which of the following is the principle of Atomic Absorption Spectroscopy?

(a) Radiation is absorbed by non-excited atoms in vapour state and are excited to higher states (b) Medium absorbs radiation and transmitted radiation is measured

(c) Colour is measured (d) Colour is simply observed

14. In Atomic Absorption Spectroscopy, which of the following is the generally used radiation source?

(a) Tungsten lamp (b) Xenon mercury arc lamp (c) Hydrogen or deuterium discharge lamp (d) Hollow cathode lamp

15. ESCA gives sufficient chemical information up to a depth about _______ armstrong in metals.

(a) 5-20 (b) 15-40 (c) 40-100 (d) 100-200

16. Discrete electrons cannot be observed in electron ionization of an atom due to which of the following reasons?

(a) Environmental disturbances (b) Same mass (c) Same charge (d) the Electron-electron interaction

17. Oxidation state of Iron in haemoglobin is

(a) +1 (b) +2 (c) +3 (d) none

18. The ligand system present in vitamin B_{12}

(a)porpyrin (b) corrin (c) Phthalocyanin (d) crown ether

19. Central metal atom/ion in chlorophyll is

(a)Iron (b) Manganese (c) Magnesium (d) Zinc

20. What are the complications that occur in severe thalassemia disease?

(a) Bone deformities (b) Enlarged spleen (c) Heart problems (d) All of the above

SECTION B – (5 x 5 = 25 marks)

Answer All the Questions

21. (a) Write a note on reaction in anhydrous sulphuric acid. **(**OR**)**

(b)What are the factors affecting extraction?

22. (a) Describe about two dimensional silicates with an example. (OR)

(b) State and explain Wade's rule with an example.

23. (a) Write notes on space groups and miller indices.(OR)

(b)Explain magnetic properties of solids.

24. (a) Describe about principle of AAS. (OR)

(b) Write notes on Koopman's theorem and chemical shift.

25 (a) Explain the structure and work function of haemoglobin. (OR)

(b) Describe about chelate therapy.

SECTION C – (3 x 10 = 30 marks)

Answer Any three Questions

26. Explain reactions in liquid ammonia and sulphur dioxide.
27. Draw and explain the structure of B_4H_{10} and B_6H_{10}.
28. Explain defects in solids.
29. Discuss theory and applications of PES.
30. Explain the structure and work functions of Chlorophyll.

18P3CH08

VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN
(AUTONOMOUS)
DEPARTMENT OF CHEMISTRY
M.Sc. DEGREE EXAMINATION - III SEMESTER
MODEL QUESTION – PHYSICAL CHEMISTRY – II

Time: 3 hrs **Max Marks: 75**

Section –A

Answer all the questions **20 x 1 = 20**

1. The de-Broglie wavelength of a particle having kinetic energy E is given by
   a) $\lambda = h/\sqrt{E}$ b) $\lambda = h/\sqrt{2mE}s$ c) $\lambda = h/\sqrt{mE}$ d) $\lambda = h/\sqrt{3mE}$

2. According to Schrodinger, a particle is equivalent to a
   a) wave packet b) single wave c) light wave d) none of the above
3. The Schrodinger time independent equation can be written as
   a) $H \Psi = E \Psi$ b) $H \Psi = (E - V) \Psi$ c) $H \Psi = (E + V) \Psi$ d) $H \Psi + E \Psi = 0$
4. For the particle moving in x-direction and having a wave function $\Psi = A\sin(kx-\omega t)$, its energy is
   a) $k^2\hbar^2/2m$ b) $k\hbar/2m$ c) $\hbar^2 k^2/2m$ d) $m^2 \hbar^2$
5. If n represents the number of eigen states of a hydrogen atom, then its discrete energy levels are proportional to
   a) n b) n^2 c) $1/n$ d) $1/n^2$
6. What is the degeneracy of H-atom in state n=3
   a) 5 b) 7 c) 9 d) 18
7. The quantum mechanical operator for the momentum of a particle moving in one dimension is given by
   a) $i\hbar\, d/dx$ b) $- i\hbar\, \delta/\delta x$ c) $i\hbar\, \delta/\delta t$ d) $- \hbar^2/2m \times d^2/dx^2$
8. The sum of the energies of the third and the fourth levels is
   a) $10\, \pi^2\hbar^2 /mL^2$ b) $10\, \pi^2\hbar^2 /3mL^2$ c) $11\, \pi^2\hbar^2 /mL^2$ d) $15\, \pi^2\hbar^2 /mL^2$
9. The rate of change of chemical potential with temperature will in the order for solids, liquids and gases is
   a) $S^s < S^l < S^g$ b) $S^l < S^g < S^s$ c) $S^g < S^s < S^l$ d) $S^l < S^s < S^g$
10. The relationship between fugacity and activity coefficient is
    a) $f/P = \Upsilon$ b) $P/f = \Upsilon$ c) $P/\Upsilon = f$ d) $\Upsilon/P = f$
11. At freezing point the fugacity of water will be for solid and liquid phases is
    a) $f_{ice} = f_{water}$ b) $f_{ice} < f_{water}$ c) $f_{ice} > f_{water}$ d) none of the above
12. The expression for activity coefficient is
    a) $\Upsilon = a/c$ b) $\Upsilon = c/a$ c) $c = a\Upsilon$ d) $\Upsilon/a = c$
13. In Raman spectroscopy, using mercury vapour lamp
    a) the stokes line is more intense than the anti-stokes line.
    b) the anti-stokes line is more intense than the stokes line.
    c) the stokes and anti-stokes lines are equally intense.
    d) None of the above.

14. In a rotational spectrum, transitions are only observed between rotational levels of ΔJ =
    a) ± 1 b) ± 2 c) ± ½ d) ± 3
15. For pure vibrational spectra, the selection rule is
    a) 0 b) ± 1 c) 0, ± 1 d) ± 1,2
16. The J_{max} for a rigid diatomic molecule for which at 300 K, the rotational constant is $1.566\,cm^{-1}$, is
    a) 4 b) 6 c) 8 d) 10
13. The normal modes of vibrations of N_2O is
    a) 1 b) 3 c) 4 d) 7
14. If force constant, k, of a diatomic simple harmonic oscillator is equal to
    a) $4\, \pi^2c^2\tilde{\nu}\mu^2$ b) $4\, \pi^2c^2\tilde{\nu}\mu$ c) $4\, \pi^2c\tilde{\nu}\mu$ d) None of the above
15. The molecule which is IR-inactive and Raman-active is
    a) N_2 b) HCl c) SO_2 d) protein

16. The rotational spectrum of a rigid diatomic rotor consists of equally spaced lines with spacing equal to

a) B b) B/2 c) 3B/2 d) 2B

Section – B

Answer all the questions. **5 X 5=25**

21. a) List out the postulates of quantum mechanics and discuss about eigen value and eigen function (OR)
    b)Derive the Schrodinger equation for a particle moving in a one dimensional box.
22. a)Discuss the application of Approximation methods to ground state energy of hydrogen atom (OR)
    b)Write in detail about the Hartree-Fock's SCF method.
23. a) Derive the expression for variation of chemical potential with temperature and pressure(OR)
    b) How will you determine the fugacity of a gas from equation of state.
24. a) Write short note on various transitions in a molecule (OR)
    b) Write short account on the effect of isotopic substitution of co molecule.
25. a) Given a short account on Born-Oppenheimer approximation. (OR)
    b) Discuss the differences between Rayleigh and Raman scattering.

Section –C

Answer any three questions. **3 x 10 = 30**

26. Derive the Schrodinger's energy equation for the H – atom
27. Write detailed account on Huckel's MO theory for application to ethylene molecule.
28. Discuss the method to determine the solvent activity by vapour pressure and cryoscopic method
29. Explain rotational spectra of diatomic molecules as rigid rotors.
30. Explain the Raman's rotational spectra of symmetric top and spherical top molecules.

18P4CH09

VIVEKANANDHA COLLEGE OF ARTS & SCIENCES FOR WOMEN
(AUTONOMOUS)
DEPARTMENT OF CHEMISTRY
M.Sc. DEGREE EXAMINATION - IV SEMESTER
MODEL QUESTION- PHYSICAL CHEMISTRY – III

Time: 3 Hours Max. Marks: 75

PART – A (20 x1 = 20 Marks)
Answer all the questions

1. Molecules of a dilute gas are identical, distinguishable particles which obey…….statistics.

a) Maxwell-Boltzmann b) Bose-Einstein c) Fermi-Dirac d) Rayleigh-Jeans

2. The vibrational energy levels of a diatomic are given by

a) $E_n = (n + 1/2)\,h\nu$ b) $E_n = (n + 1)\,h\nu$

c) $E_n = (n + 2)\,h\nu$ d) all the above

3. What is the rotational partition function of H_2 at 300 K?

a) 1.923 b) 1.723 c) 1.823 d) 1.623

4. A partition function can be used to calculate

a) Free energy b) Enthalpies c) Entropies d) none of these

5. The essential contribution to the thermodynamics of the non-equilibrium systems was brought by a) Fermi b) Einstein c) Pokrovskii d) Prigogine

6. Non-equilibrium thermodynamics is concerned with transport processes and

a) energy of chemical reactions b) rates of chemical reactions

c) frequency d) state variables

7. The thermodynamic study of non-equilibrium steady states, in which entropy production and some flows are

a) Zero b) Non-zero

c) one d) none of these

8. The entropy (S) is a function of the collection of

a) Intensive variable b) Massieu potential

c) extensive quantities d) extended Massieu function

9. UV spectroscopy is useful for the detection of

a) functional group b) extent of conjugation

c) geometrical isomers d) all of these

10. The energy difference between π and π* is ….. kcal/mole

a) 186 b) 176 c) 196 d) 166

11. An auxochrome is one which is

a) colour enhancing b) atom with lone pair of electrons

c) extending conjugation d) all of these

12. The main advantage of fluorescence over UV-Vis spectroscopy is

a) Its sensitivity b) Its compatibility with separation techniques

c) Its compatibility with most analytes d) None of the above

13. NMR spectra are observed in …….. region

a) radio frequency b) microwave c) UV/Vis d) X-ray

14. Which of the following sovents cannot be used in NMR spectroscopy?

a) CCl_4 b) CS_2 c) $CHCl_3$ d) $(CCl_3)_2C=O$

15. Vicinal F-F coupling ranges from ……. cps

a) 43-370 b) 0-58 c) 0-39 d) 42-80

16. ESR is used to control the state of electron spin qubits in

a) diamond b) gallium c) silicon d) all the above

17. The molecular ion peak is usually intense for

a) aromatic compounds b) conjugated olefins

c) alcohols d) neoalkanes

18. In case of polynuclear hydrocarbons, the base peak appears

a) as parent ion peak b) at 91 due to tropyium ion

c) at 77 due to phenylcation d) None of these

19. McLafferty rearrangement base peak in mass spectrum is usuay the base peak for

a) adehydes b) ketones c) acids d) all of these

20. Mossbauer Spectroscopy associates with …… rays

a) radio b) gamma c) X-ray d) Cosmic

PART – B (5 x 5 = 25 Marks)

Answer ALL the questions

21. (a) Write down the objectives of statistical thermodynamics. (OR)

(b) Outline about distribution of distinguishable and non distinguishable particles.

22. (a) Justify the entropy production in heat flow and matter flow. (OR)

(b) Describe in detailed about Onsager reciprocal relation.

23. (a) Explain the possible types of electronic transitions in UV spectroscopy. (OR)

(b) Explain the principles and applications of fluorescence spectroscopy.

24. (a) Write a short note on spin-spin coupling. (OR)

(b) Explain g value and coupling constant in ESR spectroscopy.

25. (a) Write a brief note on Mclattery rearrangement. (OR)

(b) Explain line width and isomer shift in Mossbauer spectroscopy.

PART – C (3 x 10 = 30 Marks)

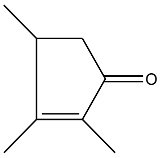
Answer ANY THREE questions

26. Derive Bose-Einstein statistics law.

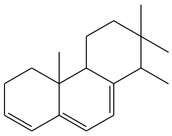
27. Explain the verification of Onsager reciprocal relation using diffusion phenomenon.

28. Calculate λ_{max} for the following compounds.

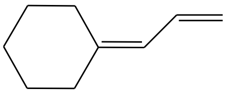
(i)



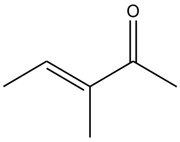
(ii)



(iii)



(iv)



29. Define chemical shift. What are the factors affecting chemical shift.

30. Draw and explain the components of mass spectrophotometer.

18P4CHE03

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(Autonomous)
M.Sc. DEGREE EXAMINATION
MODEL QUESTION PAPER- ENVIRONMENTAL CHEMISTRY

Time: THREE Hour **Maximum : 75 Marks**

SECTION A – (20 x 1 = 20 marks)
Answer ALL Questions.

1. Which of the following is produced when electrical discharges pass through oxygen in air?
   a) Ozone b) Methane c) CFCs d) Lead compounds
2. Temperature of outer mesosphere is
   a) 93°C b) -93°C c) 5°C d) -5°C
3. Disease caused by eating fish found in water contaminated with industrial waste having mercury is
   a) Minamata disease b) Brights disease c) Hashimotos disease d) Osteosclerosis.
4. Which of the following play significant role in depletion of ozone layer?
   a) Oxides of nitrogen b) Oxides of carbon c) Oxides of sulphur d) None of the above
5. The optimum value in natural water is _______
   a) 2-4ppm b) 4-7ppm c) 4-6ppm d) 2-7ppm
6. By aerobic process ________ of biodegradable water is converted into the biomass.
   a) 10% b) 30% c) 50% d) 75%
7. Reacting the water with ________ removes the odour due to the phenols.
   a) $KMnO_4$ b) MnO_4 c) Potassium d) Magnesium
8. Bio-chemical oxygen demand (BOD) for the first 20 days in generally referred to
   a) Initial demand b) First stage demand c) Carbonaceous demand d) All of these
9. Plastics enter the marine environment primarily by
   a) being dumped or lost there b)debris carried in runoff
   c) washing out of landfills d)none of the answers are correct
10. Which of the following is a health hazard often found in kitchen cabinets and furniture?
    a) Mold b) Radon c) Asbestos d) Formaldehyde
11. Polychlorinated biphenyls (PCBs), affecting
    a) Estrogen metabolism b)Blood Circulation
    c) Cell membrane d) Biodegradable
12. Polychlorinated biphenyls' are by products of plastics, lubricants, rubber and
    a) Paper production b) Wood production c) Steel production d) All of above
13. What is impact of overuse of inorganic fertilizers?
    a) High level of nitrates & Eutrophications b) Salinization
    c) Desalinization d)Increase soil Fertility

14. Costly and harmful pesticides can be replaced by
    a) Artificial Predators b)Natural Predators c)Small Animals d)Weeds
15. What are impact of over cultivation & over grazing ?

a) Soil Erosion, Degradation, Desertification b) Desertification & Salinization
c) Soil erosion & Salinization d) Eutrophication

16. If water containing DDT (dichloro-diphenyl-trichloroethane: $C_{14}H_9O_5$) is fed upon by cattle, it will
a) get stored in the liver b) get stored in the fatty tissues of animals
c) be excreted out with urine d) get stored in the muscle fibers

17. The simplest and most common method used in the cities is to collect and dump the waste in a ____ .
a) landfill b) river c) ocean d) any of the above

18. Which of the below is not an idea behind solid waste management?
a) Control of waste generation b) Storage and collection
c) Disposal d) Stop waste generation

19. Under which rule of Government, guidelines for solid waste management are followed today?
a) Municipal Solid Waste Rules, 2000 b) Municipal Solid Waste Rules, 2016
c) Solid Waste Rules, 2000 d) Solid Waste Rules, 2016

20. Which gas produced in open dumps from the decomposition of biodegradable waste?
a) Ethane b) Methane c) Propene d) Ethene

SECTION B – (5 x 5 = 25 marks)

Answer ALL Questions

21. (a). Explain the terms of chemical potential and chemical equilibria in environmental Concept. (OR)
(b). Write short notes on fundamentals of environmental chemistry

22. (a). Discuss the detrimental effects of inorganic pollutants in water. (OR)
(b). Explain redox potential in water chemistry.

23. (a). Write a short note on Polychlorinated Biphenyls. (OR)
(b). Write a note on sources of asbestos in the environment.

24. (a) Write the short notes on Environmental Implications of Fungicides and Herbicides. (OR)
(b).Explain the Environmental implications of Insecticides.

25. (a) Write notes on Municipal waste into road making. (OR)
(b). Explain notes on Waste management.

SECTION C – (3 x 10 = 30 marks)

Answer Any THREE questions.

26. Explain the sample techniques for air, water and soil in Environmental chemistry.
27. What is COD and BOD? Explain with suitable method to calculate.
28. Explain the Environmental Implications of Polymers and Plastics.
29. Explain the Abatement procedures for fungicides and Herbicides pollution.
30. Write the notes on the following (i) Utilizing agricultural waste (ii) Wealth from waste.

18P3CHED01

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
DEPARTMENT OF CHEMISTRY
M.Sc.,DEGREE EXAMINATION –III SEMESTER
MODEL QUESTION-EDC- APPLIED POLYMER CHEMISTRY

Time: 3hrs **Max.Marks: 75**

PART-A

Answer all the questions **20x1= 20**

1. Which one of the following is not correct?

   a) A homopolymer is a polymer made from only one type of monomer

   b) A macromolecule is a larger molecule built by the repetition of small chemical unit

   c) A copolymer is a polymer made from two or more different monomer

   d) A heteropolymer is a polymer that has atoms besides carbon as per the chain back bone

2. Caprolactum is the monomer of

   a) Nylon-6 b) PVC c) Bakelite d) Teflon

3. Compounds containing reactive double bonds can undergo__________reaction.

   a) Redox polymerization b) Ionic polymerization c) Chain polymerization d) Condensation polymerization

4. Which of the following is an example for network polymer?

   a) Terylene b) Bakelite c) nylon-6,6 d) polyester

5. The metal ion used in Zeigler-Natta catalyst is

   a) Ir b) Rh c) Ti d) Ni

6. Polymerization of olefins and dienes catalysed by organo metallic compounds are known as

   a) Free radical polymerization b) Coordination polymerization

   c) Addition polymerization d) Condensation polmerization

7. Which one of the following is an example of co-polymer?

   a) Buna-S b) Teflon c) Polypropylene d) PVC

8. The species which can best serve as an initiator for cationic polymerization is:

   a) $LiAlH_4$ a) HNO_3 b) $AlCl_3$ c) BaLi

9. A polymeric molecules possess the molecular weight __________

   a) Different b) Fixed c) That cannot be determined d) May be determined

10. The strength of the polymer increases with __________in molecular weight.

    a) Decrease b) Increase c) Slightly increase d) No change

11. The impact strength is measured as_________

    a) Elasticity b) Strength c) Permeabilityd) Toughness

12. The molecular weight of the polymers is measured by :

a) Viscosity method b) Light scattering method c) Ultracentrifugtion method

d) All the above

13. The polymer which is used for injection moulded articles is

a)Polystyrene b) styrene-acrylonitrile c) acrylonitrile-butadiene-styrene d) polyethylene

14. Why are the plasticisers added with polymers?

a) To hold other constituents of plastic together

b) To reduce cost and enhance the strength and hardness of plastics

c) To improve flexibility and to reduce the temperature and pressure required for moulding of plastics

d) None of the above

15. Elastomers and plastics differ due to their properties of________

a) Resistivity b) Dielectric strength c) Acoustic insulation d) Extensibility

16. ________is a reinforcement filler.

a) Carbon black b) Chinaclay c) $BaSO_4$ d) Chalk

17. Adhesives are examples for

a) Polystrenes b) Epoxy resins c) Polyester d) Polyvinyl chloride

18. The polymer which is used in the fabrication of artificial blood vessels is__________

a) Polyester b) Polyvinyl chloride

c) Flouro alkoxy substituted phosphonitrilic polymers d) Teflon

19. Silicone polymers are___________

a) Linear polymer b) Addition polymer c) Cross-linked polymer d) Copolymer

20. Which of the following phenolic resins are suitable for the decorative laminates?

a) Caustic soda catalyzed resols b) Ammonia catalyzed resols

c) Spirit resols d) Resites

PART-B

Answer all the questions **5x5=25**

21. a). Explain the mechanism of free radical polymerization. (OR)

b). Give account on emulsion polymerization technique.

22. a). Write note on Ziegler-Nata Catalyst and its advantages. (OR)

b). Describe block and graft co-polymers with examples.

23. a). Write note on thermal degradation of polymer. (OR)

b). How the molecular weight of the polymer is measured by viscometry method.

24. a). What are fibres? Write the preparation method and uses of carbon fibre. (OR)

    b). Discuss the compounding technique by extrusion method.

25. a). Explain the preparation, properties uses of polyamides. (OR)

    b). What are high temperature and fire resistant polymers.

PART-C

Answer any three questions **3x10= 30**

26. How the condensation polymerization is carried out in homogeneous and heterogeneous systems.
27. Write the synthetic methods of any two cross-linked polymers and list out their applications.
28. What is glass transition temperature? What are the factors that affect the glass transition temperature?
29. Write note on processing techniques of polymer.
30. Discuss about the applications of polymers in medical field.