COURSE STRUCTURE

AND

DETAILED SYLLABUS OF

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FOR

B.Sc THREE YEAR DEGREE COURSE

(I, II & III YEAR)

BHAGWANT UNIVERSITY

SIKAR ROAD, AJMER - 305001

RAJASTHAN, INDIA

BHAGWANT UNIVERSITY

ORDINANCES GOVERNING

UG - (B.Sc./B.Sc.(Hon s))

Course for Year

Scheme 2008-2009

DEPARTMENT VISION

We inspire and enable a better world through our scholarship and teaching about management and organizations. To achieve academic excellence in Applied by imparting in depth knowledge to the students, facilitating research activities and cater to the ever changing industrial demands and societal needs.

To educate the students in the recent developments of Applied Science in Mathematics, Physics and Chemistry, encourage research activities and innovative techniques, develop employability skills so as to equip them excel globally.

DEPARTMENT MISSION

1. To build a vibrant and supportive community of scholars by markedly expanding opportunities to connect and explore ideas.
2. To provide quality UG education to the students through state of art education.
3. To provide a learning environment that helps students to enhance problem solving skills, be successful in their professional.
4. To establish Industry Institute Interaction to make students ready for the industrial environment.
5. To promote research based projects/activities in the emerging areas of Mathematics, Physics and Chemistry.
6. To bring out the students as committed and employable technocrats in the field of Electrical and Electronics Engineering.
7. To prepare the students for addressing societal challenges through competitive and innovative research. To ensure the graduates acquire leadership qualities and commitment towards lifelong learning.

PROGRAM EDUCATIONAL OBJECTIVES

Promote the education of mathematics, science, and general education. Strengthen academic research and academic exchange. Improve industry-academia cooperation and community service. Demonstrate a breadth and depth of knowledge in the discipline of Mathematics, Physics and Chemistry.

Program Educational Objectives are broad statements that describe the carrier and professional accomplishment that the program is preparing UG.

The **Program Education Objectives** (PEO's) of Mathematics, Physics and Chemistry Programme are:

1. To equip the students with knowledge in design and control of emerging Mathematics, Physics and Chemistry systems and create a scope for addressing the industrial and societal needs.
2. To instill computing skills for multi-disciplinary approach, team work and ethical attitude
3. To empower the students for meaningful research, innovation and lifelong learning.

PROGRAM OUTCOMES

1. **Engineering Knowledge:** Apply the knowledge of Mathematics, Physics, Chemistry, Science, Engineering fundamentals, and an Applied Science specialization to the solution of Mathematics, Physics, Chemistry, Science.

2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principle of mathematics, natural science and engineering science.

3. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural societal, and environmental considerations.

4. **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.

5. **Modern Tool Usage:** Create, select and apply appropriate techniques, resources, and modem engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assist societal, health, safety, legal and cultural issues and consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solution in societal and environmental contexts, and demonstrates the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with the society at large such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES:

1. Analyze, design and provide an Applied Science solution in the areas of Mathematics, Physics, Chemistry, and Science.
2. Analyze, design and provide an Applied Science solution in the areas of Science and Engineering.

Ordinances Governing UG courses

(Applied Science)

3 year Course Leading to Bachelors Degree

1. **APPLICABILITY:**
   This Ordinance shall apply to Bachelors Degree [B.Sc., B.Sc.(Hon's)] for Yearly scheme

2. **DEFECTIONS :**
   a) **Academic Programme /Programmes** shall mean a programme of course and /or any other Component leading to the degree of UG & PG courses.
   b) **Academic Year** is a period of 12 months devoted to completion of requirements specified in the scheme of teaching and the related examinations.
   c) **Board of Studies (BOS)** shall mean the Board of Studies of the Faculty / Institute concerned.
   d) **Course** means a component of the academic programme, carrying a distinctive code no. and specific Marks assigned to it.
   e) **Three hour** lecture each theory Paper /2 hour lab/ per week.
   f) **University** shall mean Bhagwant University.
   g) **Faculty** shall mean Faculty of Humanity, Social Science , Faculty of Life Science & Applied Science & Faculty of Commerce
   h) **Examiner** shall mean an examiner who is not in the employment of the University.
   i) **Year System** - A programme wherein each academic year is apportioned into two parts known as Years.
   j) **Student** shall mean a person admitted and registered for degree programme in the Faculty of Humanity & Social Science, Faculty of Life Science & Applied Science.

3. **ADMISSION**
   Admission to 3 year (UG) course leading to degree programmes will be made as per the rules prescribed by the Academic Council of the University.

ELIGIBILITY FOR ADMISSION

    (a)   No candidate shall be eligible for admission unless he/she has passed as per detail given below

Course	Name of Faculty	Duration in Year		Eligibility
		Min	Max	
B.Sc., B.Sc.(Hon's)	Faculty of Life Science & Applied Science	3- UG	5	10+2 (Science Stream)

    (b)   Has cleared the ebgibility test such as University Entrance Exam/Any other National or State examination which is considered to be equivalent.

    (c)   Rules for student migrated from other university/ Board-
Student pursuing UG courses of recognized state university/ board may be permitted to migrate to this university in accordance of this university. For such case student admitted upto 3rd Year has to reappear in the subject in the university exam back paper for which for which equivalence standard has not been met as per standard of Bhagwant University. University shall make an Equivalence Committee for the determining purpose of equivalence and decision of Vice- Chancellor shall be final.

DURATION OF COURSE

    (a)   Total duration of the Course leading to degree programmes shall be 3 years for UG Course Course, each year comprising of two Years.

    (b)   The Maximum permissible period for completing a programmes for which the prescribed UG programme duration is **n (number of Year) Years,** shall be (n+4) Years. Under very special circumstances, the total period may further be extended by **2 Years** with the approval of the Vice-Chancellor. This excludes the period of expulsion or suspension by the University/medical leave.

4. MINIMUM REQUIREMENT TO PASS A SUBJECT

The student should prepare two assignment / quiz submitted to respected HOD 's as per Academic calendar to pass the sessional + Theory part of the subject 40% Marks with Complete continuous evaluation.

5. MINIMUM REQUIREMENT TO GET PROMOTED IN NEXT SESSION

    a. The student should clear at least 25 % subject (Theory + Practical) of studying year to get promoted in next year, (this includes fail and absent subject) even after missing or not appear in any Year.

    [Example Sem -I Comprising 6 Theory and 4 Practical's, Sem-2 comprising 6 Theory and 2 Practical total 18 subjects. Candidate to pass at least 25% of 18 equal 4.5 =5 total courses to pass in both sem I & II]

    All the student will be promoted to next academic year provided they have fulfilled attendance and Examination requirement, **b.** Grace 1% of Grand Total Marks of a Year distributed up to 25% of total subjects.

6. CURRICULAM AND MINIMUM MARKS REQUIREMENT.

2 Year per Year	Total 6 Year for U.G course Total 4 Year for P.G.
Time	16-18 Week/Year
Class hours per week	24 Class Hours

A candidate for a pass at each of the Year examination shall be required to obtain

a)   At least 40 % marks in the aggregate of each papers with Continuous Evaluation through Assignment / Quiz Viva , Seminar, Test prescribed for the examination

Paper	Max Marks	Total Marks	Min Pass Marks
Theory	70		
Continuous Assignment / quiz/ test/ Viva/ Seminar	30	100	40
Practical (Internal =50, Extemal=50)	100	100	40

b)   Provided that if a candidate fails to secure at least 40% marks in each individual paper in the examination and also in the project work/seminar.

c)   The minimum Marks requirement for Graduate/ Post Graduate degree should be 40% marks aggregate.

7. **ATTENDANCE**

All Students are normally expected to have and attendances of 75% in each subject. The Vice- Chancellor may give relaxation up to 15% on account of illness and other pre-approved occasion. However, under no circumstances. A student with an attendance of less than 60% in a subject, shall be allowed to appear in the Year-end examination of that subject In case any student appears in the examination by default, who infect has been detained by the institute on account of attendance shortage his or her result shall be treated as null and void.

8. **CANCELLATION OF ADMISSION**
The admission of a student at any stage of study shall be cancelled if:
a) He/She is not found qualified as per UGC/State Govemment/university norms and guidelines or the eligibility criteria prescribed.

or
b) He / She is involved in ragging.

or
c) He / She is found unable to complete the course within the stipulated time as prescribed.
d) He/She is found involved in creating indiscipline in the Faculty/College or in the University.
e) Fee Arrears

9. **BOARD OF STUDIES**
The constitution of the Board of Studies shall be :
(a) The HOD's of the Faculty (Chairperson)
(b) All Professors
(c) Two Associate Professors
(d) One Assistant Professors
(e) One Expert Member from outside University
(f) One external member from within University.

10. **ACADEMIC PROGRAMME COMMITTEE**
(a) There shall be an Academic Programme Committee in the Department / Faculty of the University.
(b) All the teachers of an Faculty of Study shall constitute the Academic Programme Committee of which the HOD'S of the Faculty shall act as its Chairperson. This Committee shall coordinate the implementation of the courses for optimum utilization of resources and shall also take care of the coordination of the UG & PG programmes with the other programmes run by the different Faculty of the University.

(c) The Academic programmes Committee shall meet as and when required. But at least once every Year. The Chairperson of the Committee will convene the meetings.

11. EVALUATION

The examination of the university will be open to all regular/ re-admitted / ex-student who have undergone a course of study in the university for a period specified for the programmed of study in the teaching and evaluation scheme and are not debarred from appearing in the end - Year examinations as provided in the applicable ordinance of the university.

(a) The overall weightage of a course in the Syllabi shall be determined in terms of marks assigned to the course.

(b) The distribution of weightage for various components of evaluation shall be as defined in the Teaching & Evaluation Scheme.

(c) **Conduct of Year-End Examination**

(i) All Year - end examination shall be conducted by the Controller of Examinations.

(ii) The schedule of examination shall be notified by the Controller of Examination at least 10 days prior to the first day of the commencement of Year - end examination.

(iii) For theory as well as practical examination as viva-voce, the concerned subject teacher (s) shall be the Internal Examiners. In case any External Examiners are desired, then the same shall be appointed by the Controller of Examinations the recommendations of the Head of the Department and approval of Vice- Chancellor of the university.

(d) **Assessment:**

All courses undertaken by students are evaluated during the Year using internal system of continuous assessment. The students are evaluated on Seminar , Viva ,class , tutorial participation, lab work, assignment, quiz and end Year examinations, which contribute to the final marks awarded for the subject. Students will be notified at the commencement of each courses about the evaluation methods being used for the courses and weightage given to the different assignments and evaluated activities.

In order to make the evaluation system as similar and transparent with any of the globally reputed educational institutions like MDS & Rajasthan University. Here marks obtained in the continuous assessment(Assignment / Quiz etc) and end Year examination are added together.

Distribution of Marks

Courses Theory & Assignment/quiz components

Assignment / Quiz/ Seminar/Test/Viva $=$ 30

End - Term Examination $\quad = \quad$ 70

Total $\qquad = \quad$ 100

Course with Practical Components

Internal Practical (Exam Continuous evaluation, Record) = 50

External (Practical Exam, Viva Voce) $\quad = 50$

Total $\qquad = 100$

12. **RE-EVALUATION (MAIN/BACK):**

The students, who are not satisfied with the mark awarded, may opt for reevaluation of the mark in the subject not more than 25% of total subject. For this he has to submit the prescribed application with fee to examination with in 15 days of the declaration of result.

13. **IMPROVEMENT:**

If the student whishes to improve his final division he may be permitted to apply for improvement is permitted for candidate who wish to improve them division from pass / II division. Students having overall percentage such that they are awarded less then 1st Division will be permitted to appear for improvement with in a years of declaration of result. They will be permitted to appear in any paper / subject in which score is less 60 (below 1st Division Marks). Improvement examination will be conducted in that subject for which regular/ back examination is being conducted in that period, for conducting special / Improvement examination a special fee to cover incidental expanses will be charged.

14. **DETERMINATION OF DIVISION ON DEGREE**

S.No	Division	Equivalent percentage %
1	1st Division with Distinction	75.00 but less than 100
2	1st Division	60.00 but less than 75.00
4	2nd Division	48.00 but less than 60.00
5	Pass	40.00 but less than 48.00

Note:

(a) 1st Division with Distinction: 75% or more in the total aggregate all Year.

(b) 1st Division: 60% or More in the total aggregate all Year.

(c) 2nd Division: 48% or more in the total aggregate all Year.

(d) Pass: 40% or more in the total aggregate all Year.

15. USE OF UNFAIR MEANS:

All reported cases for use of unfair means in the examination shall be placed before a Standing 'Unfair Means Hearing Committee' for decision on case basis. The actions under the category of 'Use of Unfair Means' and procedure for dealing with such cases of suspected/alleged/reported use of unfair means shall be specified by the Academic Council.

The following would be considered as unfair means adopted during examinations and other contexts:

a) Communicating with the fellow students for obtaining help.

b) Copying from the other student's script/report/paper etc.

c) Possession of any incriminating document whether used or not.

d) Any approach in direct or indirect form to influence teacher/ invigilator.

e) Unruly behavior, which disrupts academic environment.

16. STUDENTS GRIEVANCE COMMITTEE:

In case of any written representation /complaints received from the students within seven days after completion of the examination regarding setting up of the question paper etc. along with specific recommendations of the course Co-ordinators & HOD's of the Institute, the same shall be considered by the Students Grievance Committee to be constituted by the Vice-Chancellor The Vice Chancellor shall take appropriate decision on the recommendations of the Students Grievance Committee, before the declaration of result (s) of the said examination.

17. AWARD OF DEGREE

A student shall be awarded a degree if:

a) He / She has registered himself/herself, undergone the course of study, fulfilled the all requirements and secured the minimum Marks prescribed for award of the concerned degree.
b) Completion of all prescribed courses.
c) Passing of all courses individually with minimum Overall marks with 40%.
d) There are no dues outstanding in his/her name of a Faculty of the University/constituent Institution And
e) No disciplinary action is pending against him/her.

18. Not withstanding anything stated in this Ordinance, for any unforeseen issues arising, and not covered by this Ordinance, or in the event of differences of interpretation , Vice Chancellor may take a decision after obtaining, if necessary, the opinion/ advice of a Committee consisting of any or all the Directors of the Institutes. The Decision of the ViceChancellor shall be final.

B.Sc Maths Honours

Course Category

First Year:-

S.N	Sub. Code	Subject	Course Category	Con Hrs per wee t		EoSE Duration (in Hrs)		Marks Distribution		
				T	P	T	P	IA	EoSE	Tot
1	01ABM101	Communication Techniques	CCC	3	0	3	0	30	70	100
2	01ABM102	Elementary Computer Applications	CCC	3	0	3	0	30	70	100
3	01ABM103	Environmental Studies	CCC	3	0	3	0	30	70	100
4	01ABM104	Inorganic Chemistry	CCC	3	0	3	0	30	70	100
5	01ABM105	Organic Chemistry	CCC	3	0	3	0	30	70	100
6	01ABM106	Physical Chemistry	CCC	3	0	3	0	30	70	100
7	01ABM107	Instrumental Methods Of Analysis	CCC	3	0	3	0	30	70	100
8	01ABM108	Higher Algebra	CCC	3	0	3	0	30	70	100
9	01ABM109	Calculus	CCC	3	0	3	0	30	70	100
10	01ABM110	Geometry & Vector Calculus	CCC	3	0	3	0	30	70	100
11	01ABM111	Discrete Mathematics	CCC	3	0	3	0	30	70	100
12	01ABM112	Mathematical Statistics	CCC	3	0	3	0	30	70	100
13	01ABM201	Practical Chemistry								100
									Total	1300

Course Category

Second Year:-

s.N	Sub. Code	Subject	Course Category	Con. Hrs.per week		EoSE Duration (in Hrs)		Marks Distribution		
				T	P	T	P	IA	EoSE	Tot
1	02ABM101	Inorganic Chemistry	CCC	3	0	3	0	30	70	100
2	02ABM102	Organic Chemistry	CCC	3	0	3	0	30	70	100
3	02ABM103	Physical Chemistry	CCC	3	0	3	0	30	70	100
4	02ABM104	Abstract Algebra	CCC	3	0	3	0	30	70	100
5	02ABM105	Differential Equation	CCC	3	0	3	0	30	70	100
6	02ABM106	Mechanics	CCC	3	0	3	0	30	70	100
7	02ABM107	Spherical Astronomy	CCC	3	0	3	0	30	70	100
8	02ABM108	Operation Research	CCC	3	0	3	0	30	70	100
9	02ABM201	Practical Chemistry								100
									Total	**900**

Course Category

Third Year:-

S. N	Sub. Code	Subject	Course Category	Cor. Hrs .per wee £		EoSE Duration (in Hrs)		Marks Distribution		
				T	P	T	P	IA	EoSE	Tot
1	03 ABM 101	Inorganic Chemistry	CCC	3	0	3	0	30	70	100
2	03ABM102	Organic Chemistry	CCC	3	0	3	0	30	70	100
3	03ABM103	Physical Chemistry	CCC	3	0	3	0	30	70	100
4	03ABM104	Industrial Chemistry	CCC	3	0	3	0	30	70	100
5	03ABM105	Abstract Algebra	CCC	3	0	3	0	30	70	100
6	03ABM106	Analysis	CCC	3	0	3	0	30	70	100
7	03ABM107	Numerical Analysis & Differential Equations	CCC	3	0	3	0	30	70	100
8	03ABM108	Dynamics of Rigid Bodies	CCC	3	0	3	0	30	70	100
9	03ABM109	Fundamental of "C" (Theory)	CCC	3	0	3	0	30	70	100
10	03ABM201	Practical Chemistry								100
									Total	1000

First Year:-

01ABM101   **Communication Techniques**

UNIT-1
- Words and Sentences
- Verbs/Tenses
- Questions / Questions Tags
- Modal Verbs
- The Passive

UNIT- II
- Nouns and Articles
- Determiners
- Reported Speech
- Adjectives and Adverbs

UNIT- III
- Prepositions
- Pronouns
- Conditionals
- Linking Words

UNIT- IV
- Essay and Report Writing
- Review Writing

UNIT- V
- Applications and Letter
- Precis Writing

Suggested Readings:

1. Communication Technique Dr.Nupur Tandon
2. Communication Technique and Grammar Aspects : shukla, Arora Maheswari
3. Professional Communication : Koneru Tata Mc-Graw Hill Publishing Ltd.,New Delhi
4. Communication techniques And Gramatical Aspects : Ruchi ,Dheer ,Jaill, Shukla Pathak,& Maheswari—CBH Publication
5. Effective Technical Communication : Rizvi -Tata Mc-Graw Hill Publishing Ltd.,New Delhi

Elementary Computer Applications

UNIT-1

Introduction to Information Technology, evolution and generation of computers, type of computers, micro, mini, mainframe and super computer. Architecture of a computer system: CPU, ALU, Memory (RAM, ROM families) cache memory, input/output devices, pointing devices.

UNIT- II

Number system (binary, octal, decimal and hexadecimal) and their inter-conversions, character codes (ASCII, EBCDIC and Unicode). Logic gates, Boolean Algebra, machine, assembly and high level language including 3GL and 4GL.

UNIT- III

Concept of Operating system, need and types of operating systems, batch, single user, multi-processing, distributed and time-shared operating systems. Process and memory management concepts. Introduction to Unix, Linux, Windows, Windows NT systems and their simple commands.

UNIT- IV

Internet: Concepts, email services, world wide web, web browsers, search engines, simple programs in HTML, type of HTML documents, document structure element, type and character formation, tables, frames and forms.

UNIT- V

Word processing packages, standard features like tool bar, word wrap, text formatting, paragraph formatting, effect to text, mail-merge. Presentation Packages: Slide creation, slide shows, adding graphics, formatting, customizing and printing.

Suggested Readings:

1. Elementary Computer Application K. K. Sud (Author)

2. Elementary Computer Application by Yogesh Goyal (Author)

3. A Graded Course In Computer Applications Goyal Brothers Prakashan
4. Internet for Everyone, Alexis Leon and Mathews Leon, Vikas Publishing House Pvt. Ltd, New Delhi.

01ABM1O3   **Environmental Studies**

UNIT I:

The Multidisciplinary nature of environmental studies Definition , scope and importance Need for public awareness.

UNIT II:

Natural Resources: Renewable and non-renewable resources:

Natural resources and associated problems, Forest resources: Use and over-exploitation, deforestation, case studies, Timber,extraction, mining, dams and their effects on forests and tribal people, Water resources: Use and over-utilization of surface and groundwater, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modem agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources. Case studies. Land resources: Land as a resource, Land degradation, man induced Landslides, soil erosion and desertification.

UNIT III:

Ecosystems , Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem Ecological succession Food chains, food webs and ecological pyramids .Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem ,Grassland ecosystem . Desert ecosystem Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT IV:

Biodiversity and its conservation, Introduction - Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a megadiversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man- wildlife onflicts.Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT V:

Environmental Pollution, Definition, Causes, effects and control measures of Air pollution, Water pollution , Soil pollution .Marine pollution,Noise pollution, Thermal pollution , Nuclear hazards, Solid waste Management: Causes, effects and control measures of urban and industrial wastes.Role of an individual in prevention of pollution .Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Suggested Readings:

1. Blackwell's Concise Encyclopedia of Ecology by Peter Calow Publication Date: 1999

2. Conservation and Environmentalism by Robert C. Paehlke

3. A Dictionary of Environment and Conservation by Michael Allaby (Editor); Chris Park (Editor)

4. Environmental Science Loose Leaf - Import, 25 Oct 2014 by G. Tyler Miller (Author), Scott Spoolman (Author)

01ABM104

UNIT-1

Idea of de Brogile matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of 0 and 02, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s. p, d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configuration of the elements, effective nuclear charge.

UNIT-II

Covalent Bond - Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electronpair repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, CIF_3, $IC1- 2$, and H_2O,

UNIT-III

MO theory, homonuclear and heteronuclear (CO and NO) diatomi molecules, multicentre bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

Unit- IV

Periodic Properties

Atomic and ionic radii, ionization energy, electron affinity and electronegativity- definition, methods of determination and trends in periodic table, applications in predicting and explaining the chemical behaviour.

s-Block Elements Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, and introduction to alkyls and aryls. **p-Block Elements**

Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides and halides of groups 13- 16, hydrides of boron-diborane and higher boranes, borazine, properties borohydrides.

Unit- V

Ionic Solids- Ionic structures, radius ratio and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Bom-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule. Metallic bond- free electron, valence bond and band theories. Weak Interactions- Hydrogen bonding, van der Waals forces.

Fullerenes, carbides, flurocarbons, silicates (Structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalides. Chemistry of Noble Gases

Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

Suggested Readings:
1. BOWSER J., Inorganic chemistry, 1993.
2. COTTON F.A., WILKINSON G. and GANS P.L, Basic inorganic chemistry, 2d ed., 1987.
3. JOLLY W.J., Modem inorganic chemistry, 2d ed., 1991.
4. KATAKIS D. and GORDON G., Mechanisms of inorganic reactions, 1987.
5. PORTERFIELD W.W, Inorganic chemistry, 1984.
6. SHARPE A.G., Inorganic chemistry, 3d ed., 1992.
7. WALTON Paul, Beginning Group Theory for Chemistry, Oxford University Press, 1998.

UNIT-I

Structure and Bonding

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

Mechanism of Organic Reactions

Curved arrow notation, drawing electron movements with arrows, halfheaded and double headed arrows, homolytic and heterolytic bond breaking. Types of reagents-electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediatescarbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with example). Assigning formal charges on intermediates and other ionic species.

UNIT-II

Stereochemistry of Organic Compounds

Concept of isomerism. Types of isomerism. Optical isomerism-elements of symmetry, molecular chirality, enatiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of ennantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

Geometric isomerism- determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism- conformational analysis of ethane and nbutane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Difference between configuration and conformation.

UNIT-III

Alkanes and Cycloalkanes

IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation (withspecial reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes. Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity Cycloalkanes-nomenclature, methods of formation,

chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings(cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring: banana bonds.

UNIT-IV

Alkenes

Nomenclature of alkenes, methods of formation, mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanisms involved in hydrogenation, electrophilic and free radical additions. Markownikoff 's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration hydroxylation and oxidation with $KMnO_4$. Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene.

Cycloalkenes, Dienes and Alkynes

Methods of formation, conformation and chemical reactions of cycloalkenes. Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions-1,2 and 1,4 additions, Diels-Alder reaction. Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroborationoxidation, metal-ammonia reductions, oxidation and polymerization.

<div align="center">UNIT-V</div>

Arenes and aromaticity

Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure. Stability and carbon- carbon bond lengths of benzene, resonance structure, MO picture. Aromaticity: the Huckle rule, aromatic ions. Aromatic electrophilic substitution- general pattern of the mechanism, role of Complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel- Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction. Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes and biphenyl.

Alkyl and Aryl Halides

Nomenclature and classes of alkyl halides, Methods of formation, chemical reaction. Mechanisms of nucleophilic substitution reactions of alkyl halides, SN2 and SN1 reactions with energy profile diagrams. Polyhalogen compounds: chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides. Synthesis and uses of DDT and BHC.

Suggested Readings:

1. ANASTAS Paul, Green Chemistry : Theory and Practice, Oxford University Press, 1998.
2. ASTRUC d., Methodes et techniques de la chimie organique, 1999.
3. BAKER D. and ENGEL R., Organic chemistry, 1992.
4. BRAUNSTEIN p., Metal clusters in chemistry, 3 volumes, 1999.
5. BROWN W.H., Introduction to organic chemistry, 4th ed., 1988.
6. CAREY F.A., Organic chemistry, 1987.
7. EDELMANN F.T. et HAIDUC I., Supramolecular organometallic chemistry, 1999.
8. EGE S.N., Organic chemistry, 2d ed., 1989.
9. HECHT SYDNEY M., Bioorganic Chemistry - Peptides and Proteins, Oxford University Press, 1998.
10. HOLUM J.R., Fundamentals of general organic and biological chemistry, 4th ed., 1990.
11. JONES Philip and KNOCHEL Paul, Organozinc Reagents - A Practical Approach, Oxford University Press, 1998.
12. LE CORRE Maurice, Chimie organique - Reactions - Mecanismes - Fonctions, coll. "Sciences", 1994.
13. MEHROTRA R.C and SINGH A., Organometallic chemistry : a unified approach, 1991.

01ABM106 **Physical Chemistrj**

<div align="center">UNIT-I</div>

Colloidal State
Definition of colloids, classification of colloids. Solids in liquids (sols): properties- kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions); types of emulsions, preparation. Emulsifier. Liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids.

<div align="center">UNIT-II</div>

Gaseous States
Postulates of kinetic theory of gases, deviation from ideal behavior, van der Waals equation of state.
Critical Phenomena:PV isotherms of real gases, continuity of states, the isotherms of van der Waals equation, relationship between critical constant and van der Waals constants, the law of corresponding states, reduced equation of state.
Molecular velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on Joule-Thomson effect.)

<div align="center">UNIT-ni</div>

Liquid State
Intermolecular forces, structure of liquids (a qualitative description)Structural differences between solids, liquids and gases.
Liquids crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.

<div align="center">UNIT-IV</div>

Solid State
Definition of space lattice, unit cell. Laws of crystallography-(i)Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry elements in
crystals. X-ray diffraction by crystals. Derivation of Bragg equation. Determination of crystal structure of NaCl, KC1 and CsCl (Laue's method and powder method). Catalysis, Characteristics of catalyzed reactions, classification of catalysis, miscellaneous examples.

<div align="center">UNIT-V</div>

Solutions, Dilute Solutions and Colligative Properties
Ideal and non-ideal solutions, methods of expressing concentration of solutions, activity and activity coefficient. Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

Suggested Readings:

1. ALBERTY R.A. and SILBEY R.J, Physical chemistry, 1991.
2. CLIFFORD Anthony, Fundamentals of Supercritical Fluids, Oxford University Press, 1998.
3. COMPANION A.L., Chemical bonding, 2d ed., 1979.
4. DENBIGH K.G., The principles of chemical equilibrium, 4th ed., 1981.
5. KETTLE s.f., Physicochimie inorganique - Une approche basee sur la chimie de coordination, 1999.
6. LAIDLER K.L. and KEITH J., Chemical kinetics, 3d ed., 1990.
7. LEVINE I.N., Physical chemistry, 3d ed., 1988.
8. LIDE D. R., Handbook of Cemistry and Physics, 1999.
9. MEITES L., An introduction to chemical equilibrium and kinetics, 1981.
10. MOORE J.W. and PEARSON R.G., Kinetics and mechanism, 3d ed., 1981.
11. MOZUMDER A., Fundamentals of Radiation Chemistry, Academic Press, 1999.
12. PARMON V. N., Chemistry for the Energy Future, Blackwell Science, 1999.
13. REID C.E., Chemical thermodynamics, 1990.
14. SAPSE Anne-Marie, Molecular Orbital Calculations for Biological Systems, Oxford University Press, 1998.
15. SMITH E.B., Basic chemical thermodynamics, 4th ed., 1990.

01ABM107   **Instrumental Methods Of Analysis**

An introduction to the principles and methods for analysis of chemicals using appropriate instrumentation. All modem analytical methods will be discussed in lecture. Laboratory exercises will emphasize simple preparation and the use of spectrophotometers (UV, VIS, IR), chromatographs (GC and HPLC), electrochemical methods, colorametric and other optical analytical methods

Theory and application of modem instruments in chemical procedures. Standard spectroscopic methods including Fourier transform infrared spectroscopy, nuclear magnetic resonance spectroscopy and ultraviolet spectroscopy. Separation techniques using high pressure liquid chromatography and gas chromatography. Other topics relevant to advanced chemical instrumentation will also be covered.

Electroanalytical and electrogravimetric methods; potentiometric and coulometric methods; conductometric titrations; polarography and amperometric titrations; methods based on infrared, ultraviolet, and visible spectroscopy; flame photometry; atomic absorption spectrometry; gas chromatographic methods; methods based on nuclear magnetic resonance spectroscopy; fluorescence analysis; mass spectrometry.

Suggested Readings:

1. Instrumental Methods of Analysis Paperback - 1 Dec 2004 by Willard (Author)

2. Instrumental Methods of Analysis (Chemistry) Hardcover - February 1,1988

3. Instrumental Methods of Analysis Paperback - December 1, 2004 by Willard (Author), Merritt (Author), Dean (Author), Settle (Author)

01ABM108 -HIGHERALGEBRA

UNIT-1

Number system, basic binary operations on the set of integers, ordering of the integers, inequalities, well ordering principle, mathematical induction, division algorithm, divisibility principle, and their distributions, greatest common divisor, least common multiple, Euclidian algorithm, fundamental theorem of arithmetic, Fibonacci sequence, linear Diophantine equations, Diophantine equations of second degree, general integer solutions of the equations of $x2 + y2 + z2 = w2, (x, y, z, w) = 1, xn +yn = wn$,prime numbers, Goldbach conjecture.

UNIT II

Continued fractions: Conversion, quadratic surd, convergents, formation of convergents, property of convergents, recurring continued fractions, relation between successive convergents, complete quotient, relation between convergents and fraction, the difference.

Recurring series: Order and sum of a recurring series, summation of series.

Theory of equations: General properties of equations , character and position of the roots, representation of equations and its roots graphically.

UNIT III

Relations between roots and coefficients, symmetric functions of roots, transformations of equations, Solutions of cubic equations, solutions of multivariable linear equations using vedic mathematics and other methods.

Suggested Readings:

1. Topics in Algebra by I.N. Herstein
2. Abstract Algebra by Dummit and Foote
3. Algebra by Michael Artin
4. Algebra by T.Hungerford (Springer)
5. Lectures in Abstract Algebra by N.Jacobson (Has 3 volumes!)
6. Algebra by Anthony Knapp. (2 Volumes.)

01ABM109 - CALCULUS

UNIT 1

Tangents and normals, pedal equation, Derivative of the l^ngili of an arc.tnaxima, minima and saddle points of functions of uvtij vuriiJbloK Lagrange's multiplier method estpimsiurrs piatial di fTerailialhin I-tiler's theorem on homogeneous functions

UNIT-H

Curvature. various formulae, centre of curvature, chord of curvature and related problems, evolutes. envelopes, asymptotes, concavity and convexity, singulat point double point. curve tracing mi Cartesian and polar co-ordinates.), Jacobjaus. Beta and Gamma functions

UNIT-III

Double and triple integral^ Diiichlet's integrals. change of order of integration in double integrals, quadrature, rectification, intrinsic equation, volume and surfaces of solids of revolution.

Suggested Readings:

1. **Calculus of Several Variables,** by Serge Lang (Springer).

2. **Second Year Calculus,** by David M. Bressoud (Springer)

3. **Introduction to Calculus and Analysis, Volume II,** by Richard Courant and Fritz John (Springer).

4. **Advanced Calculus: A Differential Forms Approach,** by Harold M. Edwards (Birkhauser).

5. **Calculus, Volume 2,** by Tom Apostol (Wiley).

6. **Advanced Calculus,** by R. Creighton Buck (Waveland).

7. **Calculus on Manifolds,** by Michael Spivak (HarperCollins)

01ABM110 VECTOR CALCULUS AND GEOMETRY

UNIX 1

K llipw and hyperbola: Various properties of ellipse and hyperbola
General t-i]tuitiiJiL or socoml degree: Tflcio^ of conics, ceiilci of ;i conic, co-ordinates of Aн center, equation of the conic referred to centei as origin, asymptotes of a come. lengths and position of'axes of a standard conic, eccentricity, loci. directrices, avis. lattis rectum of a conic, yeitex and locus of the parabola. bracing of ellipse and hypciiwla
I he palur equation of a conic: Pol™ co-ordinates, polar equation of a straight line . circle and conic, focal chord. auxiliary circle, tiacmg of conic ! r~ L - e cost > . tangents. asymptotes perpendicular lines. a«md. polar to a conic.

UNIT - II

Sphere: Plane section of a sphere, tangent plane, pole and polar plane, orthogonal spheres. radical plane, radical centre
Cone: Reciprocal cone, right circular cone, enveloping cone Cylinder
Right circular cylinder, enveloping cyILoder
Central ton holds Ellipsoid, tangent plane, polar, polar lures, enveloping cone, enveloping cylmdei. section ivitli ,i given center, normal, con jug. hie diameters And dvimeijul planes and their properties, general equation of second degree in ilu« dimensions. intersection of a line and :i conicoids. tangent lines and tangent plane, condition of tfiimeitcy. plane section with м given centei. diniuetj ai plane, principal planes and principal directions

UNIT-III

Vector differentmhon gradient divergence and curl. Identities involving these operators and related problems.
Vк tor IniegiHtion; I iue and "in LLce integral, theorems of Oattss Green's ami Stuhe'- and pioblenis based on ilie-e theorems

Suggested Readings:

1. Geometry And Vector Calculus Kedar Nath Ram Nath Rg College Roads, Meerut, Uttar Pradesh
2. Vector and Geometric Calculus Paperback - December 18, 2012 by Alan Macdonald (Author)

01ABM111 -DISCRETE MATHEMATICS

I"7sTT-I

SMS RrliiioiLS nud Functions: Combination of setts. i^niT: 9iid mlniiic sets, uncountable mlinii; sets, **binary relation*, equivalence relation* and partitions, parrial order relation* and lattice*. Clums and -** cbainSv a job scheduling n^blcni, ojie-to-oiie, fniFO fnst iavtnibk fiiiicTLisus. Mathematical rune mans, exponential and logarithmic functions, sequences. indexed classes fit seT?. reeuisively defined functions, cardinality. algorithms and functions.

UNIT - II

Logic nud RropDiitionnl Calculus: Propositions and compound propositions, basic Logical operations, propositions and tirith tables. tautologies and contradictions. logical equivalence, algebra of

propositions, conditional and b[-conditional statements, artitmems. Logical implication, propositional functions, qu anti tiers, negation of quantified statements

Boole a n Algebra; Basic definitions, duality, basic theorems. Boolean iLpebias as lattices., representation theorem, sum of products form for sers. sum of products frcmi for Boolean algebras, minimal Boolean expressions, prime iniplicaiits. logic gates and circuits, truth tables Boolean functions

XTHlT-m

Cii n[)Li TUfcroryt Data stnu; 1 lit e~. graphs and multipaplli . subgraphs , isomorphic and liomeO morph ic graphs paths . dunueetivity. the bridges of Kvniiiibeii, traveruible inultifrraphv. labeled and "weighted graphs, complete, tejtilat and bipartite fHphs. tree graphs, plan ill graphs, graph colorings, shortest paths Direettd Crttphu Directed graphs. basic definitions .rooted trees, sequential represent at nan sJ' directed graphs.

Suggested Readings:

1. "Elements of Discrete Mathematics" by C L Liu

2. "Discrete Mathematics" by Norman L Biggs

3. "Discrete Mathematics with Applications" by Thomas Koshy

4. "Discrete Mathematics and Its Applications" by Kenneth Rosen

5. "Discrete Mathematics" by Nicodemi O

6. "Discrete Mathematics" by R Krishna Kumar

01ABM112 -MATHEMATICAL STATISTICS

rSTT-I

Probability: Law of total and compound probability, conditional probability. Bay's theorem, mathematical expectation*, moment*, moment aeneranna function*. ciumUant* and cuiuutrsnt aeneimina functions. measures of skewness and kiurosis.

UXTT-II

ratyiriat |]rob,ibilj<> driiribuhnii Binomial rmd PoisSLOti s distributions , tittina of Binomial and Poission distribution. rectangular distribution with important properties

UNIT III

Nsrmtl dfslribillion and its properties, the principle of least squares and curse fittins. brim-jar? distribution; Correlation and regression, multiple and partial correlation

Suggested Readings:

1. "Statistical Inference" by G Casella and B L Berger

2. "Probability and Statistics" by M H DeGroot

3. "Theory of Point Estimation" by E L Lehmann and G Casella

4. "Introduction to Mathematical Statistics" by Robert V Hogg

5. "Introduction to Mathematical Statistics and Its Applications" by Richard J Larsen and Morris L Marx

6. "Introduction to Mathematical Statistics" by Paul G Hoel

1. Inorganic Chemistry

Semi-micro Analysis- separation and identification of four ions, cation analysis from Groups I, II, HI, IV, V and VI, anion analysis including interfering radicals.

2. Organic Chemistry

a) Determination of Melting Point

(Naphthalene),80-82o ,Benzoic acid 121.5-122o Urea 132.5-133 o , Succinic acid 184.5-185 o Cinnamic acid 132.5-133o,Salicyclic acid 154.5-158 o Acetanilide 113.5-114o m- Diniitrobenzene 90op-Dichlorobenzene 52o Aspirin 135o

(c)   Determination of boiling points Ethanol 78 o , Cyclohexane 81.4 o , Toluene 110.6 o Benzene 80 o

(d)   Mixed melting points Urea-Cinnamic acid mixture of various compositions (1:4, 1:1, 4:1)

(f) Crystallization Concept of induction of crystallization Phthalic acid from hot water (using fluted filter paper and stemless funnel) Acetanilide from boiling ethanol Benzoic acid from water

(h)   Sublimation (Simple and Vacuum)

Camphor, Naphthalene, Phthalic acid and Succinic Acid.

(B)   Qualitative Analysis

Detection of extra elements (N,S and halogens) and functional groups\ (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds.

3. PHYSICAL CHEMISTRY (ANY FIVE)

1.   To determine the specific reaction rate of the hydrolysis of methyl acetate/ ethyl acetate catalyzed by hydrogen ions at room temperature.

2.   To study the effect of acid strength on the hydrolysis of an ester.

3.   To prepare arsenious sulphide sol and compare the precipitating power of mono-,bi- and trivalent anions.

4.   To determine the percentage composition of a given mixture (non interacting systems) by viscosity method.

5.   To determine the viscosity of amyl alcohol in water at different concentrations and calculate the excess viscosity of these solutions.

6.   To determine the percentage composition of a given binary mixture by surface tension method (acetone & ethyl methyl ketone).

Books Suggested (Laboratory Courses)

1.   Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.

2.   Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett,

R.C. Denney, G.H. Heffery and J Mendham, ELBS.

3.   Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.

4.   Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.

5.   Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, Academic Press.

6.   Inorganic Syntheisis, McGraw Hill.

7.   **Experimental Organic Chemistry Vol. I&II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.**

8.   Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.

Course Category	Second Year
02ABM101	**Inorganic Chemistry**

UNIT I

Chemistry of Elements of First Transition Series

Characteristic properties of d-block elements. Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

Chemistry of Elements of Second and Third Transition series

General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii oxidation states, magnetic behaviour, spectral properties and stereochemistry.

UNIT II

Coordination Compounds

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

UNIT III

Chemistry of Lanthanide Elements

Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

Chemistry of Actinides

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides.

UNIT IV

Oxidation and Reduction

use of redox potential data-analysis of redox cycle, redox stability in water- Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements.

UNITV

Acids and Bases

Arrhenius, Bronsted-Lowry, the Lux-Hood, solvent system and Lewis concepts of acids and bases.

Non-aqueous Solvents

Physical properties of a solvent, types of solvents and their general characteristics reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

Books Suggested (Laboratory Courses)
1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.
2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett, R.C. Denney, G.H. Heffery and J Mendham, ELBS.
3. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
4. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.
5. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, Academic Press.
6. Inorganic Syntheisis, McGraw Hill.
7. Experimental Organic Chemistry Vol. I&II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
8. Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.
9. Vogel's Textbook of Practical Organic Chemistry, B.S. Fumiss, AJ. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
10. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal,East-West press.

02ABM102   **Organic Chemistry**

UNIT I

Electromagnetic Spectrum: Absorption Spectra

Ultraviolet (UV) absorption spectroscopy- absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathchromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. Infrared (IR) absorption spectroscopy- molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds.

Ethers and Epoxides

Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions- cleavage and autoxidation, Ziesel's method. Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

UNIT II

Alcohols

Classification and nomenclature. Monohydric alcohols-nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic

nature. Reactions of alcohols. Dihydric alcohols-nomenclature, methods of formation ,chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAc)4 and HI04] and pinacolpinacolone

rearrangement. Trihydric alcohols- nomenclature and methods of formation, chemical reactions of glycerol.

Phenols

Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben- Hooesch reaction, Lederer-Manasse reaction and Reimeer- Tiemann reaction.

UNIT III

Carboxylic Acids

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids.Hydroxy acids: malic, tartaric and citric acids. Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents. **Carboxylic Acid Derivatives**

Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substituion. Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterfication and hydrolysis (acidic and basic).

UNIT IV

Aldehydes and Ketones

Nomenclature and structure of carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acid. Physical properties.

Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Witting reaction. Mannich reaction. Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-kishner, LiAIH4 and NaBH4 reductions, Halogenation of enolizable ketones. An introduction to a,a unsaturated aldehydes and ketones.

UNIT V

Organic Compounds of Nitrogen

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media Picric acid. Halonitroarenes: reactivity. Structure and nomenclature of amines, physical properties.Stereochemistry of amines. Separation of a mixture of primary, secondary and teritary amines. Structural features effecting basicity of amines. Amines salts as phase-transfer catalysts. Preparation of alkyl and aryl amines(reduction of nitro compounds, nitriles),reductive animation of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hofmann bromamide reaction. Reaction of amines, electrophilic aromatic substitution in aryl aminesreaction of amines with nitrous acid. Synthetic transformation of aryl diazonium salts, azo coupling.

Books Suggested (Laboratory Courses)

1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.
2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett,
3. R.C. Denney, G.H. Heffery and J Mendham, ELBS.
4. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
5. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.
6. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, Academic Press.
7. Inorganic Syntheisis, McGraw Hill.
8. Experimental Organic Chemistry Vol. I&II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
9. Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.
10. Vogel's Textbook of Practical Organic Chemistry, B.S. Fumiss, A.J.
11. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
12. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal,East-West press.
13. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw hill.
14. Advanced Practical Physical Chemistry, Vol.I-Physical, J.B.Yadav,Goel Publishing House.
15. Advanced Experimental Chemistry, Vol.I-Physical, J.N. Gurtu and R.Kapoor, S Chand & Co.
16. Selected Experiments in Physical Chemistry, N.G. Mukherjee . J.N. Ghose & Sons.
17. Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

UNIT I

Thermodynamics-I

Definition of thermodynamic terms: system, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work. ***First Law of Thermodynamics:*** Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law-Joule-Thomson coefficient and inversion temperature. Calculation of w,q, dU, & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. ***Thermochemistry:*** standard state, standard enthalpy of formation-Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy, Kirchhoff's equation.

UNIT II

Thermodynamics-II

Second law of thermodynamics: need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature. Concept of entropy: entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases. ***Third law of thermodynamics:*** Nemst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz functio(A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G with A with P, V and T.

UNIT III

Chemical Equilibrium

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chatelier's principle. Reaction isotherm and reaction isochore- Clapeyron equation and Clausisus- Clapeyron equation, applications.

Phase Equilibrium

Statement and meaning of the terms- phase, component and degree of freedom, thermodynamic derivation of Gibbs phase rule, phase equilibria of one component system- water, CO_2 and S systems. Phase equilibria of two component system- solid-liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions- compound formation with congruent melting point (Mg- Zn) and incongruent melting point, ($NaCl-H_2O$), ($FeCl_3-H_2O$) and $CuSO_4- H_2O$)system. Freezing mixtures, acetone- dry ice. Liquid-liquid mixtures- ideal liquid mixtures, Raoult's an Henry's law. Non-ideal system-azeotropes-$HCl-H_2O$ and ethanol - water systems. Partially miscibl liquids- Phenol-water, trimethylamine, nicotine-water systems. Lower and upper consolute temperature. Effect of impurity on consolute temperature. Immiscible liquids, steam distillation. Nemst distribution law-thermodynamic derivation, applications. **pH** Definition of pH and pKa determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods. Buffers-mechanism of buffer action, Henderson- Hazel equation. Hydrolysis of salts. mCorrosion-types, theories and methods of combating it.

UNIT IV

Electrochemistry-1

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch law, Arrehenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations. Debye-Huckel-Onsagar's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method. Applications of conductivity measurements: determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

UNITY

Electrochemistry-II

Types of reversible electrodes-gas-metal ion, metal-insoluble salt anion and redox electrodes. Electrode reactions, Nemst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode- reference electrodes-standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell and its measurements. Computation of cell EMF.

potential and hydrogen over voltage. Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

Books Suggested (Laboratory Courses)
1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.
2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett,
3. R.C. Denney, G.H. Heffery and J Mendham, ELBS.
4. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
5. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.
6. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, Academic Press.
7. Inorganic Syntheisis, McGraw Hill.
8. Experimental Organic Chemistry Vol. I&II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
9. Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.
10. Vogel's Textbook of Practical Organic Chemistry, B.S. Fumiss, A.J.
11. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
12. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal,East-West press.
13. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw hill.
14. Advanced Practical Physical Chemistry, Vol.I-Physical, J.B.Yadav,Goel Publishing House.
15. Advanced Experimental Chemistry, Vol.I-Physical, J.N. Gurtu and R.Kapoor, S Chand & Co.
16. Selected Experiments in Physical Chemistry, N.G. Mukherjee . J.N. Ghose & Sons.
17. Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

02ABM104 <div style="text-align:right">**Abstract Algebra**</div>

UNIT -1

Ring, Examples of Rings, Ring with unity, Zero divisors, Integral Domain and Fields, their examples and properties. Characteristic of a ring and intergral domain. Subrings, subfields, Prime filed, Ring homomorphism, Embedding of Rings, Field of quotients of an integral domain.

UNIT - II

Ideals and their properties. Principal ideal and principal ideal ring, Prime ideal, Maximal ideal. Ideals and Quotient rings, Euclidean rings, Unique Factorisation Domain, Polynomial rings, Remainder theorem, Factor theorem, Polynomials over the rational fields.

UNIT - III

Vector Spaces : Definition and examples of a vector spaces, subspaces, Sum and direct sum of subspaces, linear span, linear Dependence, Independence and their basic properties, Basis, finite dimensional vector spaces, Existence theorem for basis, invariance of the number of elements of a basis set, Dimension, existence of complimentary subspace of a subspace of a finite dimensional vector space, dimension of sums of subspaces, quotient space and its dimension.

UNIT - IV

Linear transformations :   Linear Transformations and their representation as matrices,thealgebra of linear transformations, Syllaster Law of Nullity. Change of basis, Dual space,Dual Basis, Bidual space, Adjoint of a linear transformation, Annihilator of a sub space.

UNIT - V

Eigenvalues and Eigenvectors, Similar matrices, equivalent matrices,Similarity of Linear transformations, Reduction to triangular form, Minimal Polynomial. Diagonalisation of Matrices.

Books Suggested

1. "Contemporary Abstract Algebra" by Joseph A Gallian

2. "Abstract Algebra" by David S Dummit

3. "Basic Abstract Algebra" by Bhattacharya

4. "Topics in Abstract Algebra" by Parthasarathi M

5. "A Course In Abstract Algebra" by V K Khanna

02ABM105   **Differential Equation**

UNIT -1

Differential equations of first order and first degree, linear differential equations, Bemoulle's equation, Exact differential equations.Differential equations of first order and higher degree;Clairauts form and singular solutions, geometrical interpretation of differential equations, Linear differential equations with constant coefficients, Ordinary homogeneous linear differential equations.

UNIT - II

Linear differential equations of second order, Normal Form, changing the independent variable. Methods of variation of parameters and of operator factors. Simultaneous differential equations, Total differential equations, Exact differential equations of nth order, Riccati's equations, Existence and uniqueness theorems.

UNIT - III

Series solution of differential equations, Power series method, Bessel, Legendre, and Hypergeometric equations.

UNIT - IV

Partial differential equations of the first order, Lagrange's solution, Some special type of equations which can be solved easily by methods other than the general method, Charpit's general method of solutions.

UNIT-V

Partial differential equations of second and higher orders, Classification of linear Partial differential equations of second order, Homogeneous and Nonhomogeneous equations with constant coefficients.

Books Suggested

1. "Elementary Differential Equations" by W E Boyce and R DiPrima

2. "Differential Equations For Dummies" by Steven Holzner
3. "Schaum's Outline of Differential Equations" by Richard Bronson and Gabriel Costa

4. "Differential Equations" by Inc BarCharts

5. "Differential Equations and Linear Algebra" by Gilbert Strang

6. "Differential Equations" by Paul Blanchard and Robert L Devaney

UNIT -1

Analytical conditions of equlibrium of coplanar forces, Friction, Virtual work.

UNIT - II

Common Catenary , Forces in three dimensions, Poinsot's central axis, Stable and unstable equilibrium.

UNIT - III

Velocities and Accelerations along radial and transverse directions, and along tangential and normal directions, Simple Harmonic Motion, Rectilinear motion under variable laws.

UNIT - IV

Hook's law, related problems on horizontal and vertical elastic string , Motion in resisting medium.

UNIT - V

Constrained motion on smooth plane curves (Circular and Cycloidal Motion). Impact (Direct and Oblique). Central orbits, *p - r* equation, Apses, Time in an orbit, Kepler's laws of planetary motion.

Books Suggested

1. "Mechanics for Engineers: Dynamics" by F P Beer and Jhonston

2. "Vector Mechanics for Engineers: Statics" by David Mazurek and Ferdinand Johnston Beer

3. "Mechanics of Materials For Dummies" by James H Allen III

4. "Classical Mechanics" by H Goldstein

5. "Mechanics" by L D Landau and E M Lifhitz

02ABM107   **Spherical Astronomy**

Spherical Trigonometry: Fundamental formulae of spherical trigonometry, (excluding circles and areas), Solutions of right angled triangles, Latitudes and Longitudes on the surface of the earth. Astronomy: Celestial sphere, Diurnal motion, Twilight, Atmospheric refraction, Meridian circle, planetary motions, Time planetary phenomenon, Precession and notation.

Books Suggested

18. Textbook on Spherical Astronomy 7th Edition textbook Real Author: W. M. Smart Editor: R. M. Green
19. Textbook on Spherical Astronomy 6th Edition by W. M. Smart (Author), R. M. Green (Editor)

Basics of Operational Research: Origin & Development of Operational Research, Definition and Meaning of Operational Research, Different Phases of an Operational Research Study, Scope and Limitations of Operational Research, Mathematical Modeling of Real Life Problems. Linear Programming: Introduction to Linear algebra. Solution of a system of Linear Equations, Linear independence and dependence of vectors, Concept of Basis, Basic Feasible solution, Convex sets. Extreme points, Hyperplanes and Halfspaces, Convex cones, Polyhedral sets and cones. Linear Programming Problem Formulation, solution by Graphical Method, Theory of Simplex Method, Simplex Algorithm, Two phase Method, Chames-M Method, Degeneracy, Theory of Duality, Dual-simplex method.

References /Suggested Readings:
1. G. Hadley: Linear Programming. Narosa, Reprint, 2002.
2. G. Hadley: Linear Algebra, Narosa, Reprint, 2002.
3. Hamdy A. Taha: Operations Research-An Introduction, Prentice Hall, 9th Edition, 2010.
4. A. Ravindran, D. T. Phillips and James J. Solberg: Operations Research- Principles and Practice, John Wiley & Sons, 2005.
5. F.S. Hillier. G.J. Lieberman: Introduction to Operations Research- Concepts and Cases, 9th Edition, Tata Mc-Graw Hill, 2010.

(A)   Instrumentation
Colorimetry
(a)   Job's method (b) Mole-ratio method Adulteration- Food stuffs. Effluent analysis, water analysis.

OR

Solvent Extraction: Separation and estimation of Mg(II) and Fe(II) Ion Exchange Method: Separation and estimation of Mg(II) and Zn(II).

(B)   Synthesis of (Any six)
(a)   Sodium trioxalato ferrate (III), Na3[Fe(C2O4) 3]
(b)   Ni-DMG complex,[Ni(DMG)2]
(c)   Copper tetrammine complex [Cu(NH3)4]SO4.
(d)   Cis-and trans-bisoxalato diaqua chromate (III) ion.
(f)   p-nitroacetanilide
(g)   p-bromoacetanilide
(h)   2,4,6- tribromophenol
(i)   Methyl orange
(j)   Methyl red
(k)   Benzoic Acid
(l)   Aniline
(m)   m-nitroaniline
(C)   Organic Qualitative Analysis
Analysis of an organic mixture containing two solid components using water, NaHCO3, NaOH for separation and preparation of suitable derivatives.
(D)   Laboratory Techniques
Steam Distillation
Naphthalene from its suspension in water
Clove Oil from cloves Separation of o-and-p-nitrophenols **OR**
Column Chromatography Separation of fluorescene and methylene blue Separation of leaf pigments
from spinach leaves Resolution of racemic mixture of (±) mandelic acid **OR**
Stereochemical Study of Organic Compounds via Models
(i)   R and S configuration of optical isomers.
(ii)   E,Z configuration of geometrical isomers.
(iii)   Conformational analysis of cyclohexane and substituted cyclohexanes.
(E)   PHYSICAL CHEMISTRY (ANY SIX)
1.   To determine the strength of the given acid conductometrically using standard alkali solution.
2.   To determine the solubility and solubility product of a sparingly soluble electrolyteconductometrically.
3.   To study the saponification of ethyl acetate conductometrically
4.   To determine the ionisation constant of a weak acid conductometrically.
5.   To titrate potentiometrically the given ferrous ammonium sulphate solutionusing KMnO4/K2Cr2O7 as titrant and calculate the redox potential of Fe++/Fe+++ system on the hydrogen scale.

7. To verify law of refraction of mixtures (e.g. of glycerol and water) using Abbe's refractometer.
8. To determine the specific rotation of a given optically active compound
9. Determination of molecular weight of a non-violatile solute by Rast method/ Backmann freezing point method.
10. Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebullioscopy.
11. To verify Beer-Lambert law for KMn04/K2Cr207 and determine the concentration of the given solution of the substance.

Books Suggested (Laboratory Courses)
1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.
2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett,
3. R.C. Denney, G.H. Heffery and J Mendham, ELBS.
4. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
5. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.
6. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, Academic Press.
7. Inorganic Syntheisis, McGraw Hill.
8. Experimental Organic Chemistry Vol. **I&n, P.R.** Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
9. Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.
10. Vogel's Textbook of Practical Organic Chemistry, B.S. Fumiss, A.J.
11. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
12. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal,East-West press.
13. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw hill.
14. Advanced Practical Physical Chemistry, Vol.I-Physical, J.B.Yadav,Goel Publishing House.
15. Advanced Experimental Chemistry, Vol.I-Physical, J.N. Gurtu and R.Kapoor, S Chand & Co.
16. Selected Experiments in Physical Chemistry, N.G. Mukherjee . J.N. Ghose & Sons.
17. Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

UNIT-I

Metal-ligand Bonding in Transition Metal Complexes

Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral , tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

Thermodynamic and Kinetic Aspect of Metal Complexes

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar and octahedral complexes.

UNIT-II

Magnetic Properties of Transition Metal Complexes

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of is and ieff values, orbital contribution to magnetic moments, application of magnetic moment data

Electronic Spectra of Transition Metal Complexes

Types of electronic transition, selection rules of d-d transitions, spectroscopic ground state, spectrochemical series. Orgel-energy level diagram for dland d9 states, discussion of the electronic spectrum of $[Ti(H20)6]3+$ complexion.

UNIT-III

Organometallic Chemistry

Definition, nomenclature and classification of organometallic compounds.Preparation, properties, bonding and applications of alkyls and aryls of Li, Al,Hg, Sn and Ti, a brief account of metal-ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

UNIT-IV

Basics of Bioinorganic Chemistry

Essential and trace elements in biological processes, metallporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to $Ca2+$. Nitrogen fixation.

<center>**UNIT-V**</center>

Hard and Soft Acids and Bases(HSAB)

Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

Silicones and Phosphazenes

Silicones and phosphazenes as examples of organic polymers, nature of bonding in triphosphazenes.

Books Suggested (Laboratory Courses)

1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.

2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett,

1. R.C. Denney, G.H. Heffery and J Mendham, ELBS.

2. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.

3. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.

4. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, AcademicPress.

5. Inorganic Syntheisis, McGraw Hill.

6. Experimental Organic Chemistry Vol. **I&n, P.R.** Singh, D.S. Gupta and

7. K.S. Bajpai, Tata McGraw Hill.

8. Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.

9. Vogel's Textbook of Practical Organic Chemistry, B.S. Fumiss, A.J.Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.

10. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal,East-West press.

11. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGrawhill.

12. Advanced Practical Physical Chemistry, Vol.I-Physical, J.B.Yadav,GoelPublishing House.

13. Advanced Experimental Chemistry, Vol.I-Physical, J.N. Gurtu andR.Kapoor, S Chand & Co.

14. Selected Experiments in Physical Chemistry, N.G. Mukherjee . J.N. Ghose& Sons.

15. Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

03ABM102   **Organic Chemistry**

UNIT-I

Spectroscopy
Nuclear Magnetic resonance (NMR) spectroscopy.
Proton magnetic resonance(lH NMR) spectroscopy, nuclear shielding and dishielding chemica shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2,-tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

UNIT-II

Organometallic Compounds
Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reaction.
Organozinc compounds:formation and chemical reactions. Organolithium compounds: formation and chemical reactions.
Fats, **Oil** and DetergentsNatural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates.

UNIT-III

Organic Synthesis via Enolates
Acidity of a-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethy acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate.Alkylation of 1,3-dithianes. Alkylation and acylation of enamines.

UNIT-IV

Carbohydrates
Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erithro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters, Determination of ring size of monosaccharides.
Cyclic structure of D(+)- glucose. Mechanism of mutarotation. Structure of ribose and deoxyribose.
An introduction to disaccharides(maltose, sucrose and lactose) and polysaccharides(starch and cellulose) without involving structure determination.

Amino Acids, Peptides, Proteins and Nucleic Acids
Classification, structure and stereochemistry of amino acids. Acid base behavior, isoelectric point and electrophoresis. Preparation and reactions of aamino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structures of peptides and proteins, level of protein structure. Proteins denaturation/ renaturation. Nucleic acids: introduction, Constitution of nucleic acids. Ribnonucleosides and ribonucleotides. The double helical structure of DNA.

Synthetic Polymers

Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers. **Synthetic Dyes**

Colour and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and indigo.

Books Suggested (Laboratory Courses)

1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.
2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett, R.C. Denney, G.H. Heffery and J Mendham, ELBS.
3. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
4. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.
5. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, AcademicPress.
6. Inorganic Syntheisis, McGraw Hill.
7. Experimental Organic Chemistry Vol. I&II, P.R. Singh, D.S. Gupta andK.S. Bajpai, Tata McGraw Hill.
8. Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.
9. Vogel's Textbook of Practical Organic Chemistry, B.S. Fumiss, A.J.Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
10. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal,East-West press.
11. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGrawhill.
12. Advanced Practical Physical Chemistry, Vol.I-Physical, J.B.Yadav,GoelPublishing House.
13. Advanced Experimental Chemistry, Vol.I-Physical, J.N. Gurtu andR.Kapoor, S Chand & Co.
14. Selected Experiments in Physical Chemistry, N.G. Mukherjee . J.N. Ghose& Sons.
15. Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

UNIT-I

Elementary Quantum Mechanics

Black-body radiation, Planck's radiation law, photoelectric effect, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect, de Brogile hypothesis, the Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates, of quantum mechanics, particle in a one dimensional box. Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

UNIT-II

Molecular orbital theory

Basic ideas- criteria for forming M.O from A.O, construction of M.O's by LCAO-H2 + ion, calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of 6, 6*,9, 9* orbitals and their characteristics. Hybrid orbitals-sp, sp2, sp3, calculation of coefficients of A.O.'s used in these hybrid orbitals. Introduction to valence bond model of H2, comparison of M.O. and V.B. models.

UNIT-III

Spectroscopy

Introduction : electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Bom-Oppenheimer approximation, degrees of freedom.

Rotational Spectrum

Diatomic molecules, Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.

Vibrational Spectrum

Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups. Raman Spectrum concept of polarizability, pure rotational and pure vibrational Raman Spectra of diatomic molecules, selection rules.

UNIT-IV

Electronic Spectrum

Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Frank-Condon principle. Qualitative description of 6, 9- and n M.O., their energy levels and the respective transitions.

Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus-Drapper law, Stark- Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluroscence, phosphorescence, nonradiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions- energy transfer processes (simple examples)

UNIT-V

Solutions, Dilute Solutions and Colligative Properties

Ideal and non-ideal solutions, methods of expressing concentration of solutions, activity and activity coefficient. Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

Books Suggested (Laboratory Courses)
1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.
2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett,
a) R.C. Denney, G.H. Heffery and J Mendham, ELBS.
3. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
4. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.
5. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, Academic Press.
6. Inorganic Syntheisis, McGraw Hill.
7. Experimental Organic Chemistry Vol. I&II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
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10. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal,East-West press.
11. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw hill.
12. Advanced Practical Physical Chemistry, Vol.I-Physical, J.B.Yadav,Goel
b) Publishing House.
13. Advanced Experimental Chemistry, Vol.I-Physical, J.N. Gurtu and R.Kapoor, S Chand & Co.
14. Selected Experiments in Physical Chemistry, N.G. Mukherjee . J.N. Ghose & Sons.
15. Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

03ABM104   **Industrial Chemistry**

Chemical Technology Basic principles of distillation, solvent extraction, solid-liquid leaching and liquidliquid extraction, separation by absorption and adsorption. An introduction into the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators. Scaling up operations in chemical industry. Introduction to clean technology. 2. Industrial Gases and Inorganic Chemicals (a) Industrial Gases: Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene, (b) Inorganic Chemicals: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate. Ill Industrial Metallurgy Preparation of metals (ferrous and nonferrous) and ultra pure metals for semiconductor technology.

Suggested Readings

1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.

2. R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.

3. J. A. Kent: Riegel s Handbook of Industrial Chemistry, CBS Publishers, New Delhi.

4. S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi.

5. A. K. De, Environmental Chemistry: New Age International Pvt, Ltd, New Delhi.

6. S. M. Khopkar, Environmental Pollution Analysis: Wiley Eastern Ltd, New Delhi.

03ABM105   **Abstract Algebra**

UNIT -1

Ring, Examples of Rings, Ring with unity, Zero divisors, Integral Domain and Fields, their examples and properties. Characteristic of a ring and intergral domain. Subrings, subfields, Prime filed, Ring homomorphism, Embedding of Rings, Field of quotients of an integral domain.

UNIT - II

Ideals and their properties. Principal ideal and principal ideal ring, Prime ideal, Maximal ideal. Ideals and Quotient rings, Euclidean rings, Unique Factorisation Domain, Polynomial rings, Remainder theorem, Factor theorem, Polynomials over the rational fields.

UNIT - III

Vector Spaces : Definition and examples of a vector spaces, subspaces, Sum and direct sum of subspaces, linear span, linear Dependence, Independence and their basic properties, Basis, finite dimensional vector spaces, Existence theorem for basis, invariance of the number of elements of a basis set, Dimension, existence of complimentary subspace of a subspace of a finite dimensional vector space, dimension of sums of subspaces, quotient space and its dimension.

UNIT - IV

Linear transformations : Linear Transformations and their representation as matrices,thealgebra of linear transformations, Syllaster Law of Nullity. Change of basis, Dual space,Dual Basis, Bidual space, Adjoint of a linear transformation, Annihilator of a sub space.

UNIT - V

Eigenvalues and Eigenvectors, Similar matrices, equivalent matrices,Similarity of Linear transformations, Reduction to triangular form, Minimal Polynomial. Diagonalisation of Matrices.

Suggested Readings

1. "Contemporary Abstract Algebra" by Joseph A Gallian
2. "Abstract Algebra" by David S Dummit
3. "Basic Abstract Algebra" by Bhattacharya
4. "Topics in Abstract Algebra" by Parthasarathi M
5. "A Course In Abstract Algebra" by V K Khanna

03ABM106   **Analysis**

UNIT -1

Real Number System as a complete Ordered Field. The point set theory, Open and Closed sets, Limit point of a set, Neighbourhood, Bolzano-Weierstrass theorem, Heine-Borel theorem, Compactness, connectedness, Cantor's ternary set.

UNIT - II

Definition and example of a metric space, Diameter of a set, Bounded set, Open sphere, Interior point and Interior of a set, Derived and Closure of set, Closed set, Closed Sphere, Properties of Open and Closed sets, Boundary point of set. Convergent and Cauchy sequences, Complete metric space, Cantor's Intersection theorem. Dense subset, Baire Catagory theorem.

UNIT - III

Limit of a function, Continuous function, Theorem on necessary and sufficient conditions for continuity of a function, Uniform continuity, Contracting mapping, Banach Fixed Point theorem, Equivalant matrices, Compactness, Sequentially compactness, Totally Bounded space, Finite Intersection properties.

UNIT - IV

Complex Numbers as ordered pairs, Complex plane, Geometrical representation, Connected and compact sets, Curves and region in the complex plane, Statement of Jordan curves theorem, Extended complex plane and stereographic projection, Complex valued functions limits, Convergence,continuity, Differentiailbility in the extended plane, Analytic functions.Cauchy-Reimann equations (Cartesian and Polar forms).

UNITV

Harmonic functions, Construction of an analytic function, Conformal mapping, Bilinear transformation and its properties, Fixed points, Cross ratio, Inverse point, Elementary maps., Z, sin Z and log Z

Suggested Readings

1. "Functional Analysis" by G Bachman and L Narici

2. "Introduction to Functional Analysis" by A E Taylor

3. "Functional Analysis" by B V Limaye

4. "Introductory Functional Analysis with Applications" by Erwin Kreyszig

5. "Functional Analysis" by P K Jain

6. "Functional Analysis: A First Course" by Nair

03ABM107   **Numerical Analysis & Differential Equations**

Second and higher order ordinary linear differential equations with constant Coefficients- complementary function- particular integrals (standard types) Cauchy-Euler differential equation. Simultaneous linear differential equations (two variables) with constant coefficients. Solutions of second order ordinary linear differential equations with variables coefficients by the following methods. (i). When a part of complementary function is given (ii). Changing the independent variable (iii). Changing the dependent variable (iv). Variation of parameters (v). Conditions for exactness and the solution when the equation is exact.

Simultaneous linear algebraic equations: Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method). Crout's method, Cholesky Decomposition method. Iterative method, Jacobi's method, Gauss-Seidal's method, Relaxation method.

Suggested Readings

1. "Some Topics in Nonlinear Functional Analysis" by M C Joshi and R K Bose

2. "Functional Analysis and Applications" by S Kesavan
3. "Numerical Methods for Partial Differential Equations: Finite Difference and Finite Volume Methods" by Sandip Mazumder

4. "Numerical Methods for Partial Differential Equations" by G Evans and J Blackledge

5. "Partial Differential Equations for Scientists and Engineers" by Stanley J Farlow

6. "Numerical Solution of Partial Differential Equations: Finite Difference Methods" by G D Smith

03ABM108   **Dynamics of Rigid Bodies**

UNIT I

Introduction - Definition - Velocity - Resultant velocity - Components of velocity and acceleration in cartesian coordinates - Tangents and Normal components of velocity and acceleration - Radial and Transverse components of velocity and acceleration - Motion of a particle along a straight line under uniform acceleration - Problems - Simple Harmonic Motion - Definition - Equations of S.H.M - Properties of S.H.M. - Composition of two S.H.Ms. - Problems.

UNIT II

Introduction - Impulse and Impulsive force - Definitions - Principle of conservation of linear momentum - Newton's experimental law - Direct and oblique impact of two smooth spheres - Change in kinetic energy and impulse imparted due to collision - Impact of sphere on a fixed plane - Problems.

UNIT III

Two dimensional motion of a particle - Introduction - Projectile - Trajectory - Horizontal range - Velocity of projection - Angle of projection - The path of a projectile is a parabola - Range and time of flight on a horizontal plane -Range and time of flight on an inclined plane - Problems.

UNIT IV

Definition - Central force - Central orbit - Areal velocity - Differential equation of the central orbit in polar co-ordinates - p-r equation of the central orbit - Given the central orbit to find the law of force - Given the law of central force to find the orbit - Problems.

UNITV

Moment of Interia of simple bodies - Parallel and Perpendicular axes theorems - Motion of a rigid body about a fixed horizontal axis - Kinetic Energy of rotation - Moment of momentum - Period of oscillation of a compound pendulum - Simple equivalent Pendulum - Interchangeability of centre of suspension and centre of oscillation - Problems.

Suggested Readings

1 Title Dynamics of Particles and Rigid Bodies: A Systematic Approach Author Ai '   Rao
2. "Rigid Body Dynamics of Mechanisms: 1 Theoretical Basis" by Hubert Hahn
3. "Theory of Machines and Mechanisms" by Uicker J J
4. "Kinematics and Dynamics of Machines" by G H Martin

Introduction to Internet, Connecting to the Internet Hardware , Software & ISPs, Search Engines, Web Portals, Online Shopping, Email - Types of email, Compose and send a message. Reply to a message, Working with emails.

Software and its Need, Types of Software - System software, Application software, System Software - Operating System, Utility Program, Algorithms , Flow Charts - Symbols, Rules for making Flow chart, Programming languages, Assemblers, Compilers and Interpreter, Computer Applications in Business.

Evolution of Computers - Generations, Types of computers, Computer system characteristics, Basic components of a Digital Computer - Control unit, ALU, Input/Output functions and memory, Memory addressing capability of a CPU, Word length of a computer, processing speed of a computer, Computer Classification.

Suggested Readings

1. "Foundations for Programming Languages" by John C Mitchell

2. "Types and Programming Languages" by Benjamin C Pierce

3. "Programming Languages: Concepts and Constructs" by Ravi Sethi

4. "Introduction to Programming Languages" by Bansal

5. "Fundamentals of Programming Languages" by Horowitz Ellis

(A) Instrumentation
Colorimetry
(a) Job's method (b) Mole-ratio method
Adulteration- Food stuffs.
Effluent analysis, water analysis.
OR
Solvent Extraction: Separation and estimation of Mg(II) and Fe(II)
Ion Exchange Method: Separation and estimation of Mg(II) and Zn(II).
(B) Synthesis of (Any six)
(a)   Sodium trioxalato ferrate (III), Na3[Fe(C204) 3]
(b)   Ni-DMG complex,[Ni(DMG)2]
. (c) Copper tetrammine complex [Cu(NH3)4]S04.
(d) Cis-and trans-bisoxalato diaqua chromate (III) ion.
(f)   p-nitroacetanilide
(g)   p-bromoacetanilide
(h)   2,4,6- tribromophenol
(i)   Methyl orange
(j)   Methyl red
(k)   Benzoic Acid
(l)   Aniline
(m) m-nitroaniline
(C) Organic Qualitative Analysis
Analysis of an organic mixture containing two solid components using water,
NaHC03, NaOH for separation and preparation of suitable derivatives.
(D)   Laboratory Techniques
Steam Distillation
Naphthalene from its suspension in water
Clove Oil from cloves Separation of
o-and-p-nitrophenols **OR**
Column Chromatography
Separation of fluorescene and methylene blue
Separation of leaf pigments from spinach leaves
Resolution of racemic mixture of (±) mandelic acid
OR
Stereochemical Study of Organic Compounds via Models
(i)   R and S configuration of optical isomers.
(ii)   E,Z configuration of geometrical isomers.
(iii) Conformational analysis of cyclohexane and substituted cyclohexanes.
(E) PHYSICAL CHEMISTRY (ANY SIX)
1.   To determine the strength of the given acid conductometrically using standard alkali solution.
2.   To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.
3.   To study the saponification of ethyl acetate conductometrically
4.   To determine the ionisation constant of a weak acid conductometrically.
5.   To titrate potentiometrically the given ferrous ammonium sulphate solution using KMn04/K2Cr207 as
     titrant and calculate the redox potential of Fe++/Fe+++ system on the hydrogen scale.

6. To verify law of refraction of mixtures (e.g. of glycerol and water) using Abbe's refractometer.
7. To determine the specific rotation of a given optically active compound
8. Determination of molecular weight of a non-violatile solute by Rast method/ Backmann freezing point method.
9. Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebullioscopy.
10. To verify Beer-Lambert law for $KMnO_4$/$K_2Cr_2O_7$ and determine the concentration of the given solution of the substance.

Books Suggested (Laboratory Courses)
1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.
2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett,
1. R.C. Denney, G.H. Heffery and J Mendham, ELBS.
2. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
3. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.
4. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, Academic Press.
5. Inorganic Syntheisis, McGraw Hill.
6. Experimental Organic Chemistry Vol. I&II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
7. Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.
8. Vogel's Textbook of Practical Organic Chemistry, B.S. Fumiss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
9. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal,East- West press.
10. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw hill.
11. Advanced Practical Physical Chemistry, Vol.I-Physical, J.B.Yadav,Goel Publishing House.
12. Advanced Experimental Chemistry, Vol.I-Physical, J.N. Gurtu and R.Kapoor, S Chand & Co.
13. Selected Experiments in Physical Chemistry, N.G. Mukherjee . J.N. Ghose & Sons.
14. Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

BHAGWANT UNIVERSITY

Sikar Road, Ajmer

Rajasthan

Syllabus

Institute of Applied Sciences

B. Sc Math's /Geology (with Physics, Chemistry)

Parti

BACHLOR OF SCIENCE B. Sc (Math's /Geology)

Subject Code	Name of Subject	Teaching Period			Max.Marks 100	
		L	T	p	External	Internal Mid Terml5 Assignmentl 5
01ABM101	Communication Technique	1	1	0	70	30
01ABM102	Elementary Computer Applications	1	1	1	70	30
01ABM103	Environmental Studies	1	1	0	70	30
Physics						
01ABM104	Mechanics	2	1	0	70	30
01ABM105	Waves & Oscillations	2	1	0	70	30
01ABM106	Electromagnetism	2	1	0	70	30
Chemistry						
01ABM107	Inorganic Chemistry	2	1	0	70	30
01ABM108	Organic Chemistry	2	1	0	70	30
01ABM109	Physical Chemistry	2	1	0	70	30
Mathematics						
01ABM110	Algebra and Matrices	3	0	0	70	30
01ABM111	Calculus	3	0	0	70	30
01ABM112	Vector Calculus and	3	0	0	70	30

	Geometry					
	Geology					
01ABM113	Physical geology and geomorphology	3	0	0	70	30
01ABM114	Crystallography and mineralogy	3	0	0		
	Laboratory					
01ABM201	Physics	0	0	2	50	50
01ABM202	Chemistry	0	0	2	50	50
01ABM203	Geology			2	50	50
	TOTAL	24	9	5		

Subject Code	Name of Subject	Teaching Period			Max.Marks 100		
		L	T	p			
						Internal	
	Physics				External	Mid Term 15	Assignment 15
02ABM101	Thermodynamics and Statistical Physics	2	1	0	70	30	
02ABM102	Electronics	2	1	0	70	30	
02ABM103	Optics	2	1	0	70	30	
Chemistry							
02ABM104	Inorganic Chemistry	2	1	0	70	30	
02ABM105	Organic Chemistry	2	1	0	70	30	
02ABM106	Physical Chemistry	2	1	0	70	30	
Mathematics							
02ABM107	Advanced Calculus	3	0	0	70	30	
02ABM108	Differential Equations	3	0	0	70	30	
02ABM109	Mechanics	3	0	0	70	30	
Geology							
02ABM110	Stratigraphy and palaeontology	3	0	0	70	30	

02ABM111	Structural geology and geotectonics	3	0	0	70	30
	Laboratory					
02ABM201	Physics	0	0	2	50	50
02ABM202	Chemistry	0	0	2	50	50
02ABM203	Geology (Structural Geology and Geotectonics)			2	50	50
	TOTAL	21	6	6		

PART m

Subject Code	Name of Subject	Teaching Period			Max.Marks 100		
		L	T	p		Internal	
	Physics				External	Mid Term 15	Assignment 15
03ABM101	Quantum Mechanics and Spectroscopy	2	1	0	70	30	
03ABM102	Nuclear Physics	2	1	0	70	30	
03ABM103	Solid State Physics	2	1	0	70	30	
	Chemistry						
03ABM104	Inorganic Chemistry	2	1	0	70	30	
03ABM105	Organic Chemistry	2	1	0	70	30	
03ABM106	Physical Chemistry	2	1	0	70	30	
	Mathematics						
03ABM107	Abstract Algebra	3	0	0	70	30	
03ABM108	Analysis	3	0	0	70	30	
03ABM109	Optimization Techniques & Statistics	3	0	0	70	30	
	Geology						
03ABM110	Indian Geology and Economic Geology	3	0	0	70	30	
03ABM111	Petrology	3	0	0	70	30	

	Laboratory					
03ABM201	Physics	0	0	2	50	50
03ABM202	Chemistry	0	0	2	50	50
	TOTAL	21	6	4		

Students should choose Mathematic or Geology as one subject in addition to physics and chemistry

COMMUNICATION TECHNIQUE

Paper Code; 01ABM 101   **Maximum Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT-1
- Words and Sentences
- Verbs/Tenses
- Questions / Questions Tags
- Modal Verbs
- The Passive

UNIT- II
- Nouns and Articles
- Determiners
- Reported Speech
- Adjectives and Adverbs

UNIT- III
- Prepositions
- Pronouns
- Conditionals
- Linking Words

UNIT- IV
- Essay and Report Writing
- Review Writing

UNIT- V

- Applications and Letter
- Precis Writing

Suggested Readings:

6. Communication Technique Dr.Nupur Tandon
7. Communication Technique and Grammar Aspects : shukla, Arora Maheswari
8. Professional Communication : Koneru Tata Mc-Graw Hill Publishing Ltd.,New Delhi
9. Communication techniques And Gramatical Aspects : Ruchi ,Dheer Jaill, Shukla Pathak ,& Maheswari—CBH Publication
10. Effective Technical Communication : Rizvi -Tata Mc-Graw Hill Publishing Ltd.,New Delhi

ELEMENTARY COMPUTER APPLICATIONS

Paper Code: 01ABM 102   **Maximum Marks: 100**

External Marks; 70   **Internal Marks; 30**

UNIT-1

Introduction to Information Technology, evolution and generation of computers, type of computers, micro, mini, mainframe and super computer. Architecture of a computer system: CPU, ALU, Memory (RAM, ROM families) cache memory, input/output devices, pointing devices.

UNIT- II

Number system (binary, octal, decimal and hexadecimal) and their inter-conversions, character codes (ASCH, EBCDIC and Unicode). Logic gates, Boolean Algebra, machine, assembly and high level language including 3GL and 4GL.

UNIT- III

Concept of Operating system, need and types of operating systems, batch, single user, multiprocessing, distributed and time-shared operating systems. Process and memory management concepts. Introduction to Unix, Linux, Windows, Windows NT systems and their simple commands.

UNIT- IV

Internet: Concepts, email services, world wide web, web browsers, search engines, simple programs in HTML, type of HTML documents, document structure element, type and character formation, tables, frames and forms.

UNIT- V

Word processing packages, standard features like tool bar, word wrap, text formatting, paragraph formatting, effect to text, mail-merge. Presentation Packages: Slide creation, slide shows, adding graphics, formatting, customizing and printing.

Suggested Readings:

1. Computer fundamental by P K Sinha
2. Fundamentals of Computers by Rajaraman V and Adabala N
3. Computer fundamental by Goel
4. Computer fundamental by Reema Thareja

ENVIRONMENTAL STUDIES

Paper Code: 01ABM 103   **Maximum Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT I:

The Multidisciplinary nature of environmental studies Definition , scope and importance Need for public awareness.

UNIT II:

Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems, Forest resources: Use and over-exploitation, deforestation, case studies, Timber,extraction, mining, dams and their effects on forests and tribal people, Water resources: Use and over-utilization of surface and groundwater, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modem agriculture, fertilizer-pesticide problems, water

logging, salinity, case studies. Energy resources: Growing energy needs, renewable and nonrenewable

energy sources, use of alternate energy sources. Case studies. Land resources: Land as a resource, Land degradation, man induced Landslides, soil erosion and desertification.

UNIT III:

Ecosystems , Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem Ecological succession Food chains, food webs and ecological pyramids .Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem .Grassland ecosystem . Desert ecosystem Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT IV:

Biodiversity and its conservation, Introduction - Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot- spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife onflicts.Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT V:

Environmental Pollution, Definition, Causes, effects and control measures of Air pollution, Water pollution , Soil pollution ,Marine pollution,Noise pollution, Thermal pollution , Nuclear hazards, Solid waste Management: Causes, effects and control measures of urban and industrial wastes.Role of an individual in prevention of pollution .Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Suggested Readings:

5. Blackwell's Concise Encyclopedia of Ecology by Peter Calow Publication Date: 1999
6. Conservation and Environmentalism by Robert C. Paehlke
7. A Dictionary of Environment and Conservation by Michael Allaby (Editor); Chris Park (Editor)
8. Environmental Science Loose Leaf - Import, 25 Oct 2014 by G. Tyler Miller (Author), Scott Spoolman (Author)

PHYSICS

PAPER I - MECHANICS

Paper Code; 01ABM 104   **Maximum   Marks: 100**

External Marks; 70   **Internal Marks; 30**

UNIT-I

Inertial frames, Galilean transformation, Non-inertial frames, fictitiousforces, Displacement, velocity and acceleration in rotating co-ordinate systems, centrifugal acceleration, Coriolis force and its applications, Focault pendulum, Invariance of velocity of light, postulates of special theory of relativity, Lorentz transformations, relativistic addition of velocities, length contraction, time dilation, Variation of mass with velocity, mass energy relation. Motion under central force, Kelper's laws, Gravitational law and field. Potential due to a spherical body, Gauss and Poisson equations for gravitational self energy.

UNIT-II

System of particles, centre of mass, motion of centre of mass, concept of reduced mass , single stage and multistage rocket, energy and momentum conservation, concepts of elastic and inelastic collisions, Analysis of collision in centre of mass frame. Angular momentum of a system of particles, Conservation of angular momentum, angular momentum about an arbitrary point, rigid body motion. Rotational motion, equation of motion of a rotating body, inertial coefficients, case of J not parallel to w, kinetic energy of rotation and idea of principles axes, Euler's Equations, Processional motion of Spinning top, Spin precession in constant magnetic field Calculation moment of inertia of a spherical shell, hollow and solid spheres and cylindrical objects (cylindrical shell, solid cylinder) about their symmetric axes through centre of mass.

UNIT-III

Kinematics of moving fluids, Equation of continuity, Euler's equation, Bemdulli's theorem, Viscous fluids, Stream line and Turbulent flow, Poiseuille's law, Capillary tube flow, Reynold's number, Stokes law, Surface tension and surface energy, molecular interpretation of surface tension, Pressure on a curved liquid surface, wetting. Elasticity, Small deformations, Young's modulus, Bulk modulus and Modulus of rigidity for an isotropic solid, Poisson ratio, relation between elastic constants. Theory of bending of beams and Cantilever, Torsion of a cylinder, Bending moments and Shearing forces. Experimental determination of elastic constants by bending of beam.

Suggested Readings:

1. Berkeley Physics Course Vol-I, Mechanics"(Mc Graw-Hill)
2. The Feymman Lectures in Physics, Vol-I, R.P. Feymman, R.B. Lighton and M. Sands.
3. R.S. Gambhir-Mechanics, (CBS Publishers and Distributors, New Delhi.)

PAPER-II WAVES & OSCILLATIONS

Paper Code: 01ABM 105   **Maximum   Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT-I

Potential well and periodic oscillations, cases of harmonic oscillations, differential equations and its solution, Kinetic and potential energy. Simple harmonic oscillations in-Spring and mass system, Simple and compound pendulum, Oscillation of two masses connected by a spring. Superposition of two simple harmonic motions of same frequency along the same line, Interference, Damped harmonic oscillators, Power dissipation,Quality factor, Driven harmonic oscillator, Transient and steady state, Power absorption, Motion of two coupled oscillators, normal modes, and motion in mixed mode effect of coupling in mechanical systems. N coupled oscillators.

UNIT-II

Waves in media: Speed of transverse waves on a uniform string, speed of longitudinal waves in a fluid, energy density and energy transmission in Waves, Typical measurement, Waves Over liquid surface, gravity waves and ripples, Group velocity and phase velocity, their measurements, superposition's of waves linear homogeneous equations and the superposition principle, nonlinear superposition and consequences. Standing waves: Standing waves as normal modes of bounded systems, Harmonics, the quality of sound: examples. Chladni's figures and vibrations of a drum. Production and detection of ultrasonic and infrasonic waves and applications.

UNIT-III

Noise and Music : The human ear and its responses: limits of human audibility. Intensity and loudness, bel and decibel, the musical scale. Temperament and musical instruments. Reflection. Refraction and diffraction of sound: Acoustic impedance of a medium. Percentage reflection and refraction at a boundary. Impedance matching for transducers, diffraction of sound, principle of a sonar system. Sound ranging.

UNIT-IV

Applied acoustics: Transducers and their characteristics. Recording and reproduction of sounds. Various systems, Measurements of frequency. Waveform. Intensity and velocity. The acoustics of halls. Reverberation period. Sabine's formula.

UNIT-V

Plane electromagnetic waves in vacuum, Wave equation for E and B of linearly, circularly and elliptically polarized electromagnetic waves, Poynting vector; Reflection and refraction at a

plane boundary of dielectrics, Polarization by reflection and total internal reflection, Faraday effect, Wave in conducting medium, Reflection and refraction by the ionosphere.

Suggested Readings:

1. D. P. Khandelwal - Oscillation and waves (Himalaya Publishing House, Mumbai).
2. R.K. Ghose - The Mathematics of waves and vibrations.
3. S.N. Ghose - Electromagnetic theory and waves propagation (Narosa Pub. House).
4. V.V. Savate - Electromagnetic field and waves (Wiley Eastern Ltd. N.Delhi).
5. I.G. Main - Vibrations and waves (Cambridge Univ Press).
6. HJ. Pain - The Physics of vibrations and waves (Macmilan 1975).

PAPER-III - ELECTROMAGNETISM

Paper Code: 01ABM 106   **Maximum Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT-1

Scalars and Vectors: dot products, triple vector product, gradient of scalar field and its geometrical interpretation, divergence and curl of a vector field, line, surface and volume integral, Flux of vector field, Gauss's divergence theorem, Green's theorem and Stokes theorem. Gauss's Law and its integral and differential form. Coulomb's law in vacuum expressed in vector forms, Potential and field of an arbitrary charge distribution at rest, Concept of multi poles, dipole and quadruple potentials and field, Work done on a charge in an electrostatic field expressed as a line integral, Conservative nature of the electrostatic field and relation with Electric potential f. Torque on a dipole in a uniform electric field and its energy, Electrostatic energy of uniformly charged sphere, classical radius of an electron. Screening of E field by a conductor.

UNIT-II

Electric field in matter : atomic and molecular dipoles, permanent dipole moment, dielectrics, polarisability, polarization vector, capacity of parallel plate capacitor with partially or completely filled dielectric, electric displacement, electrostatic energy of charge distribution in dielectric, Lorentz local field and Clausius Mossotti equation.

UNIT-III

Electrostatic field - conductors in electric field, Boundary conditions for potential and field at dielectric surface, uniqueness theorem, method of images and its applications for system of a point charge near a grounded conducting plane, Poisson's and Laplace's equations in Cartesian cylindrical and spherical polar coordinates (without derivation), solutions of Laplace's equations in Cartesian coordinates, potential at a point inside a rectangular box.

UNIT-IV

Ampere circuital law (integral and differential form), divergence of magnetic field, force on a current carrying wire and torque on a current loop in a magnetic field, magnetic dipole moment, magnetization vector, magnetisation current half order field, magnetic permeability (Linear cases)

Maxwell's equations (integral and differential form) and displacement current. E as an accelerating field: Electron gun, case of discharge tube, linearaccelerator, E as deflecting field : CRO, sensitivity of CRO.

UNIT-V

Electromagnetic induction, Faraday law (its integral and differential form) Lenz's law, mutual & self inductance, measurement of self inductance by Rayleigh's method, Charging, discharging of condensor through resistance, rise and decay of current in LR circuit, decay constant, transient in LCR circuit. AC circuit: complex number and their application in solving AC circuits,complex impedance and reactance. Series and Parallel resonance, Q-factor and sharpness of resonance.

Suggested Readings:

1. Berkeley Physics Course, Electricity and Magnetism, Ed. E.M. Procell (Me Graw Hill)
2. Haliday and Resnik, 'Physics'-Vol. II
3. D. J. Grifth "Introduction to electrodynamics", (Prentice Hall of India.)
4. A.M. Portis, 'Electromagnetic field'..
5. V.V. Savate, 'Electromagnetic field and Waves', (Wiley Eastern Ltd., New Delhi.)
6. Kakani and Hemrajani, 'Electromagnetism theory and Problems,(CBS Publishers and Distributers, New Delhi.)

PHYSICS PRACTICALS

Paper Code: 01ABM 201   **Maximum Marks: 100**

External Marks; 50   **Internal Marks: 50**

Section: A

1. Study of laws of parallel and perpendicular axes for moment of inertia.

2. Study of conservation of momentum in two dimensional oscillations.

3. Study of a compound pendulum,

4. Study of damping of a bar pendulum under various conditions.

5. Study of oscillations under a bifilar suspension.

6. Potential energy curves of a one dimensional system and oscillations in it for various

    amplitudes..

7. Study of oscillations of a mass under different combinations of springs.

8. Study of bending of a cantilever or a beam.

9. Study of torsion of a wire (static and dynamic methods)

10. Study of flow of liquids through capillaries.

11. Determination of surface tension of a liquid by different methods.

12. Study of viscosity of a fluid by different methods.

13. Conversion of galvanometer into ammeter/voltmeter

Section: B

1. Characteristics of a ballistic galvanometer.

2. Setting up and using an electroscope or electrometer.

3. Use of a vibration magnetometer to study a magnetic field.

4. Study of magnetic field due to a current.

5. Measurement of low resistance by Carey-Foster bridge or otherwise.

6. Measurement of inductance using impedance at different frequencies.

7. Measurement of capacitance using impedance at different frequencies.

8. Study of decay of currents in LR and RC circuits.

9. Response curve for LCR circuit and resonance frequency and quality factor.

10. Sensitivity of cathode-ray oscilloscope.

11. Characteristics of a choke.

12. Measurement of inductance:

13. Study of Lorentz force..

14. Study of discrete and continuous LC transmission lines.

Laboratory Tutorials (any eight)

1. Elementary Fortran programs, flowcharts and their interpretation.

2. To print out all natural even/odd numbers between given limits.

3. To find maximum, minimum and range of a given set of numbers.
4. To compile a frequency distribution and evaluate moments such as mean;Standard deviation etc.

5. To evaluate sum of finite series and the area under a curve.

6. To find the product of two matrices.

7. To find a set of prime numbers and Fibonacci series.

8. Motion of a projectile using computer simulation.

9. Numerical solution of equation of motion.

10. Motion of particle in a central force field.

11. To find the roots of a quadratic equation.

Suggested Readings:

1. Raj Kumar - Practical Physics.

2. Gupta Kumar - Practical Physics.

3. D.P. Khandelwal - Manual of Practical Physics (Alka Publication, Ajmer)

4. Prof. Saraf - Physics through experiment.

5. Practical Physics by CBH Jaipur.

PAPER -1 INORGANIC CHEMISTRY

Paper Code; 01ABM 107   **Maximum Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT-1

Idea of de Brogile matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of 0 and 02, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s. p, d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configuration of the elements, effective nuclear charge.

UNIT-II

Covalent Bond - Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electronpair repulsion (VSEPR) theory to NH_3, H_3O+, SF_4, CIF_3, $IC1- 2$, and H_2O,

UNIT-III

MO theory, homonuclear and heteronuclear (CO and NO) diatomi molecules, multicentre bonding electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

UNIT- IV

Periodic Properties

Atomic and ionic radii, ionization energy, electron affinity and electronegativity- definition, methods of determination and trends in periodic table, applications in predicting and explaining the chemical behaviour.

s-Block Elements Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, and introduction to alkyls and aryls.

p-Block Elements

Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides and halides of groups 13- 16, hydrides of boron-diborane and higher boranes, borazine, properties borohydrides.

UNIT- V

Ionic Solids- Ionic structures, radius ratio and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Bom-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule. Metallic

bond- free electron, valence bond and band theories. Weak Interactions- Hydrogen bonding, van der Waals forces. Fullerenes, carbides, flurocarbons, silicates (Structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalides. Chemistry of Noble Gases Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

Suggested Readings:

8. BOWSER J., Inorganic chemistry, 1993.
9. COTTON F.A., WILKINSON G. and GANS P.L, Basic inorganic chemistry, 2d ed., 1987.
10. JOLLY W.J., Modem inorganic chemistry, 2d ed., 1991.
11. KATAKIS D. and GORDON G., Mechanisms of inorganic reactions, 1987.
12. PORTERFIELD W.W, Inorganic chemistry, 1984.
13. SHARPE A.G., Inorganic chemistry, 3d ed., 1992.
14. WALTON Paul, Beginning Group Theory for Chemistry, Oxford University Press, 1998.

UNIT-I

Structure and Bonding

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

Mechanism of Organic Reactions

Curved arrow notation, drawing electron movements with arrows, halfheaded and double headed arrows, homolytic and heterolytic bond breaking. Types of reagents-electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediatescarbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with example). Assigning formal charges on intermediates and other ionic species.

UNIT-II

Stereochemistry of Organic Compounds

Concept of isomerism. Types of isomerism. Optical isomerism-elements of symmetry, molecular chirality, enatiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of ennantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

Geometric isomerism- determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism- conformational analysis of ethane and nbutane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Difference between configuration and conformation.

UNIT-III

Alkanes and Cycloalkanes

IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation (withspecial reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes. Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity Cycloalkanes- nomenclature, methods of formation,

chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings(cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring: banana bonds.

UNIT-IV

Alkenes

Nomenclature of alkenes, methods of formation, mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanisms involved in hydrogenation, electrophilic and free radical additions. Markownikoff 's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration hydroxylation and oxidation with KMn04. Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene.

Cycloalkenes, Dienes and Alkynes

Methods of formation, conformation and chemical reactions of cycloalkenes. Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions-1,2 and 1,4 additions, Diels-Alder reaction. Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroborationoxidation, metal-ammonia reductions, oxidation and polymerization.

UNIT-Y

Arenes and aromaticity

Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure. Stability and carbon- carbon bond lengths of benzene, resonance structure, MO picture. Aromaticity: the Huckle rule, aromatic ions. Aromatic electrophilic substitution-

logenation, sulphonation, mercuration and Friedel- Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction. Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes and biphenyl.

Alkyl and Aryl Halides

Nomenclature and classes of alkyl halides, Methods of formation, chemical reaction. Mechanisms of nucleophilic substitution reactions of alkyl halides, SN2 and SN1 reactions with energy profile diagrams. Polyhalogen compounds: chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition elimination and the

elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides. Synthesis and uses of DDT and BHC.

Suggested Readings:

14. BAKER D. and ENGEL R., Organic chemistry, 1992.
15. BRAUNSTEIN p., Metal clusters in chemistry, 3 volumes, 1999.
16. BROWN W.H., Introduction to organic chemistry, 4th ed., 1988.
17. CAREY F.A., Organic chemistry, 1987.
18. EDELMANN F.T. et HAIDUC I., Supramolecular organometallic chemistry, 1999.
19. EGE S.N., Organic chemistry, 2d ed., 1989.
20. HECHT SYDNEY M., Bioorganic Chemistry - Peptides and Proteins, Oxford University Press, 1998.
21. HOLUM J.R., Fundamentals of general organic and biological chemistry, 4th ed., 1990.

UNIT-I

Colloidal State

Definition of colloids, classification of colloids. Solids in liquids (sols): properties- kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions); types of emulsions, preparation. Emulsifier. Liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids.

UNIT-II

Gaseous States

Postulates of kinetic theory of gases, deviation from ideal behavior, van der Waals equation of state.

Critical Phenomena:PV isotherms of real gases, continuity of states, the isotherms of van der Waals equation, relationship between critical constant and van der Waals constants, the law of corresponding states, reduced equation of state.

Molecular velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on Joule-Thomson effect.)

UNIT-III

Liquid State

Intermolecular forces, structure of liquids (a qualitative description)Structural differences between solids, liquids and gases.

Liquids crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.

UNIT-IV

Solid State

Definition of space lattice, unit cell. Laws of crystallography-(i)Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry elements in

crystals. X-ray diffraction by crystals. Derivation of Bragg equation. Determination of crystal structure of NaCl, KC1 and CsCl (Laue's method and powder method). Catalysis, Characteristics of catalyzed reactions, classification of catalysis, miscellaneous examples.

UNIT-V

Solutions, Dilute Solutions and Colligative Properties

Ideal and non-ideal solutions, methods of expressing concentration of solutions, activity and activity coefficient. Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

Suggested Readings:

1. ALBERTY R.A. and SILBEY R.J, Physical chemistry, 1991.
2. CLIFFORD Anthony, Fundamentals of Supercritical Fluids, Oxford University Press, 1998.
3. COMPANION A.L., Chemical bonding, 2d ed., 1979.
4. DENBIGH K.G., The principles of chemical equilibrium, 4th ed., 1981.
5. KETTLE s.f., Physicochimie inorganique - Une approche basee sur la chimie de coordination, 1999.
6. LAIDLER K.L. and KEITH J., Chemical kinetics, 3d ed., 1990.
7. LEVINE I.N., Physical chemistry, 3d ed., 1988.
8. LIDE D. R., Handbook of Cemistry and Physics, 1999.

1. Inorganic Chemistry

Semi-micro Analysis- separation and identification of four ions, cation analysis from Groups I, II, III, IV, V and VI, anion analysis including interfering radicals.

2. Organic Chemistry

a) Determination of Melting Point

(Naphthalene),80-82o ,Benzoic acid 121.5-122o Urea 132.5-133 o , Succinic acid 184.5-185 o Cinnamic acid 132.5-133o,Salicyclic acid 154.5-158 o Acetanilide 113.5-114o m- Diniitrobenzene 90o p-Dichlorobenzene 52o Aspirin 135o

(c)   Determination of boiling points Ethanol 78 o , Cyclohexane 81.4 o , Toluene 110.6 o Benzene 80 o

(d)   Mixed melting points Urea-Cinnamic acid mixture of various compositions (1:4,1:1, 4:1)

(f) Crystallization Concept of induction of crystallization Phthalic acid from hot water (using fluted filter paper and stemless funnel) Acetanilide from boiling ethanol Benzoic acid from water

(h)   Sublimation (Simple and Vacuum)

Camphor, Naphthalene, Phthalic acid and Succinic Acid.

(B) Qualitative Analysis

Detection of extra elements (N,S and halogens) and functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds.

3. PHYSICAL CHEMISTRY (ANY FIVE)

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. To prepare arsenious sulphide sol and compare the precipitating power of mono-,bi- and trivalent anions.
4. To determine the percentage composition of a given mixture (non interacting systems) by viscosity method.
5. To determine the viscosity of amyl alcohol in water at different concentrations and calculate the excess viscosity of these solutions.
6. To determine the percentage composition of a given binary mixture by surface tension method (acetone & ethyl methyl ketone).

Books Suggested (Laboratory Courses)

1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.
2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett,
1. R.C. Denney, G.H. Heffery and J Mendham, ELBS.
2. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
3. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.
4. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, Academic Press.
5. Inorganic Syntheisis, McGraw Hill.
6. Experimental Organic Chemistry Vol. I&II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.

MATHEMATICS

PAPER I - ALGEBRA AND MATRICES

Paper Code; 01ABM 110   **Maximum Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT -1

Hermitian and skew Hermitian matrices. Elementary Operations on matrices. Inverse of a matrix. Linear independence of row and column matrices. Row rank, column rank and rank of a matrix. Equivalence of column and row ranks.

UNIT-II

Eigen values, Eigen vectors and the characteristic equation of a matrix. Cayley- Hamilton theorem and its use in finding inverse of a matrix. Applications of matrices to solve a system of linear (both homogeneous and non homogeneous) equations. Theorems on consistency of a system of linear equations.

UNIT-III

Relation between the roots and coefficients of general polynomial equation in one variable, Transformation of equations. Descarte's rule of signs. Solution of Cubic equations (Cardon method), Bi-quadratic equations.

UNIT - IV

Definition of a group with examples. Order of a finite group. General properties of groups. Integral powers of an element of a group. Order of an element of a group. Subgroups. Generation of groups. Cyclic groups, Coset Decomposition, Lagrange's theorem and its

consequences, Fermats and Euler's theorems.

UNIT - V

Normal subgroups and Quotient groups. Permutation, Permutation groups, Cyclic permutations, Even and odd permutations. The alternating group An , Cayley's theorem. Morphism of Groups, Homomorphism and Isomorphism, The fundamental theorem of homomorphism.

Suggested Readings:

1. Topics in Algebra by I.N. Herstein
2. Abstract Algebra by Dummit and Foote
3. Algebra by Michael Artin
4. Algebra by T.Hungerford (Springer)
5. Lectures in Abstract Algebra by N.Jacobson (Has 3 volumes!)
6. Algebra by Anthony Knapp. (2 Volumes.)

PAPER II - CALCULUS

Paper Code: 01ABM 111   **Maximum   Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT -1

Derivative of the length of an arc, Curvature, various formulae, Centre of curvature, Chord of curvature and related problems, Asymptotes. Concavity and convexity. Singular point, Double point. Curve tracing (in cartesian and polar co-ordinates.)

UNIT-II

Quadrature, Rectification, Intrinsic equation, Volume and Surfaces of solids of revolution.

UNIT - III

Concept and formation of a Differential Eauation, Order and Degree of a Differential equation, Equations of first order and first degree, Equation in which the variables are separable, Linear differential equations, Bemoulle's equation,

UNIT - IV

Homogeneous equations, Linear equations and Equations reducible to the linear form. Exact differential equations, Differential equations of first order and higher degree;,

UNIT -V

Linear differential equations with constant coefficients, Ordinary homogeneous linear differential equations.

Suggested Readings:

1. **Calculus of Several Variables, by Serge Lang (Springer).**

2. ~~**Second Year Calculus,**~~ **by David M. Bressoud (Springer)**

3. **Introduction to Calculus and Analysis, Volume II, by Richard Courant and Fritz John (Springer).**

4. **Advanced Calculus: A Differential Forms Approach, by Harold M. Edwards (Birkhauser).**

5. **Calculus, Volume 2, by Tom Apostol (Wiley).**

6. **Advanced Calculus, by R. Creighton Buck (Waveland).**

7. **Calculus on Manifolds, by Michael Spivak (HarperCollins)**

PAPER - III VECTOR CALCULUS AND GEOMETRY

Paper Code: 01ABM 112   **Maximum Marks: 100**

External Marks; 70   **Internal Marks; 30**

UNIT -1

(Vector Calculus)

Vector differentiation , Gradient, Divergence and Curl . Identities involving these operators and related problems. Vector Integration, Line and surface integral, Theorems of Gauss, Green's and Stake's (Statements and verification only) and problems based on these theorems.

UNIT - II

(Geometry)

General equation of second degree. Tracing of conics, Centre of a conic, Co-ordinates of the centre. Equation of the conic referred to centre as origin,Asymptotes of a conic. Lengths and position of axes of a standard conic. Eccentricity , Foci, Directrices, Axis, Latus rectum of a conic,Vertex and focus of the parabola, Tracing of Ellipse and Hyperbola. The polar equation of a conic : Polar co-ordinates , Polar equation of a straight line , circle and conic.Focal chord,.

UNIT - III

Sphere, Plane section of a sphere, Tangent plane, Pole and Polar Plane, Orthogonal spheres, Radical plane, Radical Centre,

UNIT - IV

Cone, Reciprocal cone, Right circular cone, Enveloping cone, Cylinder Right circular cylinder, Enveloping cylinder. Central conicoids: Ellipsoid, Tangent plane, Polar, Polar lines, Enveloping cone, Enveloping cylinder, Section with a given centre, Normals, Conjugate diameters and Diametral planes and their properties.

UNIT - V

General equation of second degree in three dimensions.Intersection of a line and a conicoid.Tangent lines and tangent plane. Condition of tangency. Plane section with a given centre. Diametral plane.Principal planes and Principal directions. Paraboloids, Plane sections of central conicoids, Umbilics.

Suggested Readings:

1. Geometry And Vector Calculus Kedar Nath Ram Nath Rg College Roads, Meerut, Uttar Pradesh
2. Vector and Geometric Calculus Paperback - December 18, 2012 by Alan Macdonald (Author)

Physical Geology and Geomorphology

Paper Code: 01ABM 113   **Maximum   Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT I.

The Earth- its size, shape , volume and density - views on the age of the earth - origin of the earth - Nebular , Planetesimal, Tidal and Cloud hypotheses.

UNIT II.

Geospheres-Atmosphere ,Hydrosphere and Lithosphere . External and internal geological processes and agents. The concept of rock cycle.

UNIT III.

Volcanoes : Machanism and causes of volcanic eruptions, types of volcanic eruptions and products. Global distribution of volcanoes.

UNIT IV.

Earthquakes : Types and causes .Propagation of seismic waves, focus and epicentre,theory of the origin of earthquakes, siesmograph, scale of intensity and magnitude, causes. Seismicity - Siesmic belts the world.Structural composition of the earth

UNIT V.

Weathering - Agents, types and products of weathering. Influence of climate and lithology on weathering . Soils - their nature and geological classification. Mass wasting- types , causes and controls.

UNIT VI.

Streams - Drainage basins and stream systems . Development of a typical river system. River erosion , transportation and deposition. Aggradational and degradational fluvial landforms. Concept of peneplain . Effects of fluctuation of regional base level. Major rivers of India

UNIT VII.

Oceans and seas: Ocean water - extent and composition, waves, currents and tides. Marine erosion, transportation and deposition, coastal land forms and morphological features of ocean floor. Oceanic sediments. Coral reefs - their origin and distribution.

UNIT VIII.

Glaciers - formation and morphology, flow of glacial ice, types of glaciers, erosion and transportation by glaciers. Glacial landforms.

UNIT IX

Lakes - Origin, classification and geological importance. Kayals of Kerala Wind- Cyclones, anticyclones, hurricanes, geological action of wind, Landforms of aeolian origin.A brief study of the major lakes and desert landforms of India

UNIT X.

Ground water : Source, nature and storage, porosity, permeability, aquifers and aquicludes, water table, seepages and springs, geysers, wells, artesian wells. Geological action of ground water.

Suggested Readings:

1. Physical Geology Steven Earle
2. **Download this book for free at** http://open.bccampus.ca
3. "Image Interpretation in Geology" by Drury S A
4. "Holmes Principles of Physical Geology" by Holmes A
5. "Geomorphology and Remote Sensing in Environmental Management" by S Singh

Crystallography and Mineralogy

<u>**Paper Code: 01ABM 114**</u>   <u>**Maximum Marks: 100**</u>

<u>**External Marks; 70**</u>   <u>**Internal Marks; 30**</u>

UNIT I.

Elements of crystallography. Crystalline state and crystals.Morphology of crystals, faces, edges, vertex, forms and zones.Crystal angles - plane angles, interfacial angles and solid angles. Goniometer- contact and reflection type. Law of constancy of interfacial angles. External symmetry. Crystal classes Axes - Choice of axes, labelling and orientation Crystal systems- Nomenclature of crystal faces, intercepts, parameters, unit face, Weiss notation, Miller indices Law of rational indices.

UNIT II.

Systematic crystallography. The study of symmetry, simple forms and combinations of the following crystal classes. Isometric system - Normal, tetrahedral, pyritohedral, plagiohedral,and

tetartohedral. Tetragonal system - Normal, hemimorphic, tripyramidal, pyramidal hemimorphic, sphenoidal.

UNIT III

Hexagonal system- (a) Hexagonal division- normal, hemimorphic, tripyramidal, pyramidal hemimorphic, trapezohedral.

(b) Rhombohedral division- rhombohedral, rhombohedral hemimorphic, trirhombohedral, trapezohedral. Orthorhombic system-normal, hemimorpic, sphenoidal. Monoclinic system- normal Triclinic system - normal

UNIT IV.

Brief study of the following.-Holohedral, hemihedral, tetartohedral, hemimorphic and enantiomorphic forms. Twin crystals- elements of twinning, twin axis, twin plane, composition plane Important examples of twinning. Brief study of the morphological imperfections of crystals.

UNIT V.

Physical mineralogy: Physical properties of minerals like form, habit, cleavage, fracture, colour, luster, streak, hardness, specific gravity. Thermal, electrical and radioactive properties of minerals. Chemical mineralogy : Geochemical distribution of elements. Types of bonds, ionic

radii, ionic ratios, isomorphism, solid solution, exsolution, polymorphism, pseudomorphism, mineraloids, and metamict minerals.

UNIT VI.

Optical mineralogy : Polarisation of light, polarisation by reflection, absorption, refraction. Double refraction. Construction of nicol prisms. Petrological microscope- parts and functions, mechanical and optical accessories. Birefringence, Isotropic and anisotropic substances. Uniaxial and biaxial indicatrices, optic sign.Relief,Pleochroism.

UNIT VII.

Descriptive mineralogy

a.   Classification of minerals

b.   Systematic study of the important non silicate minerals- Diamond ,Graphite , Sulphur,Gold , Silver , Copper , Realgar ,Orpiment, Stibnite , Molybdenite, Cinnabar, Sphalerite , Galena , Chalcocite, Bomite , Chalcopyrite, Pyrite, Magnetite, Haematite , Marcasite, Barite , Gypsum, Halite , Flourite , Corundum , Cryolite , Cuprite , Spinel , Chromite , Rutile , Cassiterite , Ilmenite , Monazite ,Psilomelane , Pyrolusite, Goethite , Limonite , Bauxite Calcite , Dolonite , Aragonite , Magnesite ,Siderite , Malachite , Azurite

UNIT VIII.

Structure and classification of silicate minerals with detailed physical, chemical and optical properties of the following. Olivine family, garnet family, alumino silicate family Epidote family, pyroxene family, amphibole family

UNIT IX.

Beryl, cordierite, tourmaline. Clay minerals and mica family. Feldspars, feldspathoids, Quartz and Zeolite group.

Suggested Readings:

1.   "Mineralogy" by Berry L G
2.   "A Textbook of Mineralogy" by Dana E S and Ford W E
3.   "Optical Mineralogy" by Nesse D W
4.   "Mineralogy" by Perkins D
5.   Physical Geology Steven Earle
6.   **Download this book for free at** http://open.bccampus.ca
7.   "Image Interpretation in Geology" by Drury S A
8.   "Holmes Principles of Physical Geology" by Holmes A
9.   "Geomorphology and Remote Sensing in Environmental Management" by S Singh

PRACTICAL I - CRYSTALLOGRAPHY,MINERALOGY AND PETROLOGY

PAPER 1-CRYSTALLOGRAPHY,MINERALOGY AND PETROLOGY.

A. CRYSTALLOGRAPHY

Drawing of typical, simple forms of the various classes of different systems mentioned in the theory part and the most frequently occurring crystal combinations of the following minerals

Galena, garnet, spinel, magnetite, fluorite, sphalerite, tetrahedrite, pyrite, zircon, rutile, vesuvianite, cassiterite, apophyllite, scheelite, wulfenite, chalcopyrite beryl, molybdenite, beta quartz, calcite, tourmaline, alpha quartz, barite, olivine, sulphur, topaz, stibnite, enstatite, gypsum, orthoclase, augite, hornblende, biotite, epidote, axinite, plagioclase, rhodonite, microcline. Twin crystals- fluorite, magnetite, tetrahedrite, eossiterite, zircon, chalcopyrite calcite, quartz, aragonite, staurolite, augite, gypsum, orthoclase, plagioclase.

B. MINERALOGY

Megascopic study and identification of the following minerals: Native copper, sulphur, graphite, chalcopyrite, bomite, galena, sphalerite, pyrrhotite, cinnabar, chromite, realgar, orpiment, stibnite, pyrite, cobaltite, marcasite, molybdenite, cuprite, zincite and important non-silicate minerals. Megascopic and Microscopic study of the following minerals: quartz, orthoclase, microcline, plagioclase, perthite, leucite, nepheline, olivine, enstatite, hypersthene, augite, diopside, tremolite, actinolite, hornblende, anthophyllite, biotite, muscovite, chlorite, cordierite, andalusite, sillimanite, kyanite, staurolite, calcite, sphene, apatite, zircon. Garnet. Vibration directions of the polarizer and analyser of microscopes. Use of Michel-Levy chart for the determination of birefringence, thickness of mineral section and interference colours of minerals.

C. PETROLOGY

Megascopic study and identification of the following rocks: granite, pegmatite, diorite, syenite, gabbro, anorthosite, dunite, peridotite, dolerite, rhyolite, basalt, andesite, pumice, scoria, obsidian, conglomerate, breccia, sandstone, arkose, greywackes, grit, oolitic limestone, fossiliferous limestone, shale, laterite, quartzite, marble, amphibolite, schist, gneiss, granulite, eclogite, chamockite, leptynite, phyllite.

Microscopic study and identification of the following rocks:

1. Granite, diorite, syenite, gabbro, norite, anorthosite, pyroxenite and dunite.
2. Felsite and dolerite.
3. Basalt, rhyolite and andesite.
4. Breccia conglomerate, sandstone, greywacke, arkose, fossiliferous limestone, oolitic limestone and shale.

5. Slate, phyllite, quartzite, schist, gneiss, granulite, khondalite, chamockite, eclogite, amphibolite and marble.

Suggested Readings:

1. "Mineralogy" by Berry L G
2. "A Textbook of Mineralogy" by Dana E S and Ford W E
3. "Optical Mineralogy" by Nesse D W
4. "Mineralogy" by Perkins D
5. Physical Geology Steven Earle
6. Download this book for free at http://open.bccampus.ca
7. "Image Interpretation in Geology" by Drury S A
8. "Holmes Principles of Physical Geology" by Holmes A
9. "Geomorphology and Remote Sensing in Environmental Management" by S Singh

PHYSICS

Thermodynamics and Statistical Physics

Paper Code; 02ABM 101   **Maximum   Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT-I

The Distribution of molecular velocities : distribution law of molecular velocities, Most probable, Average and R.M.S. velocities, Energy distribution function, Effusion and molecular beam, Experimental verification of the Maxwell velocity distribution, the principle of equipartition of energy. Transport Phenomenon : Mean free path, distribution of free paths, Coefficients of viscosity, thermal conductivity, diffusion and their interrelation.

UNIT-II

Thermal interaction, Zeroth law of thermodynamics, System in thermal contact with a heat reservoir (canonical distribution), Energy fluctuations, Entropy of a system in a heat bath. Helmholtz free energy, adiabatic interaction and Enthalpy, General interaction and first law of thermodynamics, Infinitesimal general interaction, Gibbs free energy, Phase transitions.

UNIT-III

Clausius-Clapeyron equation, vapor pressure curve. Heat engine and efficiency of engine, Carnot cycle, Thermodynamics scale as an absolute scale, Maxwell relations and their applications Joule Thomsonexpansion and J.T. coefficients for ideal as well as van der Waals gas, Porous plug experiment, Temperature inversion, Regenerative cooling, Cooling by adiabatic demagnetization, Liquid Helium, He-I and He-II, Super fluidity, Refrigeration through helium dilution, Quest for absolute Zero, Nemst heat theorem.

UNIT -IY

Validity of classical approximation, Phase space, Micro and Macro states thermodynamic probability, relation between entropy and thermodynamic probability, Monatomic Ideal gas, Barometric equation

UNIT - V

Specific heat capacity of diatomic gas, Specific heat capacity of solids. Black body radiation and failure of classical statistics, Postulates of quantum statistics, Indistinguishibility, Wave function and exchange degeneracy, a priory probability, Bose Einstein statistics and its distribution function, Planck distribution function and radiation formula, Fermi Diarc statistics and its distribution function, Contact Potential, Thermionic emission, Specific heat anomaly of metals, Nuclear spin statistics (ortho and para hydrogen).

Suggested Readings:

1. Berkeley Physics Course Vol. V-Statistical Physics.

2. Reif-Thermodynatnics and Statistical Physics

3. Loknathan and Khandelwal-Thermodynamics and Statistical Physics.

4. Sears-Thermodynamics Kinetic Theroy of gases and Statistical Physics.

5. Kittle - Thermal Physics.

Paper Code: 02ABM 102   **Maximum   Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT-I

Circuit analysis : Networks some important definitions, loop and nodal equations based on DC and AC circuits (Kirchhoff s Laws). Four terminal networks : current voltage conventions, open, close and hybrid parameters of any four terminal network, Input, output and mutual independence for an active four terminal network. Various circuits theorems : Superposition, Thevenin, Norton, reciprocity, maximum power transfer and Miller Theorems. Semi-conductors and Rectification: Charge densities in N and P materials, conduction by drift and diffusion of charge carriers. PN diode equation, capacitance effects, nature of charge carriers by Hall effect.

UNIT-II

Rectifiers: Half wave, full wave and Bridge rectifier, calculation of ripple factor, efficiency and regulation. Filters, Series inductor shunts capacitor, L section and TT section filters. Voltage regulation : Voltage regulation and voltage stabilization by Zener diode, voltage multiplier.

UNIT-III

Transistor and transistor bias circuits: Notations and volt-ampere characteristics for bipolar junctions transistor. Concept of load line and operating point, Hybrid parameters. Field effect transistor and its Characteristics. Use of transistor as amplifier : CB, CE, CC configurations and their equivalent circuit Analysis of transistor amplifiers using hybrid parameters and its gain frequency response. Cascade amplifiers, basic idea of direct coupled and R-coupled amplifiers, Differential amplifiers. Need of bias and stability of Q Point : stability factors, various typesof bias circuits for thermal bias stability. Fixed bias, collect to base feed back bias and four resistor bias.

UNIT-IV

Oscillators : Criteria for self excited and self sustained oscillators circuit requirement for buildup of oscillation. Basic transistor oscillator circuit and its analysis; colpitts and Hartley oscillators. R-C Oscillators, crystal oscillators and its advantages.

UNIT-V

Field effect transistors and logic circuits : Junction Field effect transistor (JFET), circuit symbols, biasing and volt-Ampere relations. Logic Circuits : Transistor as a switch, logic fundamentals, AND, OR, NOT, NOR, NAND, XOR gates. Boolean algebra, De Morgan's theorem,

positive and negative logic, logic gates circuits realization using DTL and TTL logic, Simplificatio of Boolean expressions.

Suggested Readings

1. John D. Ryder, Electronic Fundamentals and Applications.
1. Prentice Hall of India Pvt. Ltd. New Delhi.
2. John D. Ryder, Engineering Electronics : Me Graw Hill Book
3. Jacob Millman anc Christose Hailkias, Integrated Electronics
4. Analog and Digital Circuits and systems, Me Graw Hill Ltd.
5. Albert Paul Malvino, digital computer electronics, Tata Me Graw Hill Co. Ltd. New Delhi

PAPER-III-OPTICS

Paper Code: 02ABM 103   **Maximum Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT-I

Fermats Principle : reflection, refraction

General theory of image formation : Cardinal points of an optical system, general relationships, thick lens and lens combinations, Lagrange equation of magnification, telescopic combinations, and telephoto lens and eye pieces.

UNIT-II

Aberration in images : Chromatic aberrations, achromatic combination of lenses in contact and separated, Monochromatic aberrations and their reductions.

Interference of a light : The principle of superposition, two slit interference, coherence requirements of the sources, optical path retardations, lateral shift of fringes, Rayleigh refractometer and other applications. Localized fringes; thin films, applications for precision measurements for displacements, Newton's ring.

UNIT-III

Haidinger fringes : Fringes of equal inclination. Michelson interferometer, it's application for precision determination of wavelength, Wavelength difference and the width of spectral lines. Fabry Perot interferometer and etalon.

Fresnel diffraction : Half periods zones, circular aperture, Circular disc, straight edge, rectilinear propagation of light, cornu's spiral, zone plate, phase reversible zone plate.

Fraunhoffer diffraction : Single slit, double slit, n slit, Intensity distribution, Plane diffraction grating, reflection grating, concave grating, different mounting of grating, Resolving power, Reyleigh criterion, resolving power : telescope, grating, prism.

UNIT -1Y

Lasers and Holography : Spontaneous and stimulated emission, density of states, Einstein's A and B coefficients, Ration of stimulated to spontaneous transitions in a system in thermal equilibrium, Energy density of radiation as a result of stimulated emission and absorption, Condition for amplification, Population inversion, Methods of optical pumping, Energy level schemes of He-Ne and Ruby lasers, working of a laser source, Special features of a laser source and their origin. Tunable Lasers (Qualitative discussion only) Basic concepts of holography, construction of a hologram and reconstruction of the image.

UNIT-Y

Polarization of light : Meaning of polarization, polarization by reflection : Brewster law, polarization by refraction through "Pile of plates", Laws of malus, Phenomenon of double refraction, uniaxial and biaxial crystals, Huygens theory of double refraction, the ordinary and extra ordinary refractive indices. Production and Analysis of Polarized Light : production of plane polarized light, the Polaroid, Nicol prism, analyzer and polarizer, double image prisms, quarter and half wave plates, production of circularly and elliptically polarized light, rotation of plane of polarization, origin of optical rotation in liquids and in crystals. Specific rotation, Polarimeter (Laurent and biquartz)

<u>**Suggested Readings**</u>

1. Principle of Optics by B K Mathur

2. Optics by D P Khandelwal

3. Introduction to modem optics by A K Ghatak (Tata McGraw Hill)

4. Optics by Brij Lai and Subramanium.

5. An Introduction to Modem Optics by G R Fowels

6. Optics Physics by Lipson and Lipson.

7. Essentials of Lasers by Allen.

PHYSICS PRACTICALS

Paper Code: 02ABM 201   **Maximum Marks: 100**

External Marks; 50   **Internal Marks: 50**

Section -A

1. Study of adiabatic expansion of a gas or Determination of g ratio of two specific heats of a gas by Clement & Desorm's method
2. Study of conversion of mechanical energy into heat.
3. Study of temperature dependence of total radiation.
4. Application of resistance thermometry : Determine melting point of wax using platinum resistance thermometer.
5. Application of thermo emf: Plot thermo emf Vs temperature and find the neutral temperature and an unknown temperature,
6. Conduction of heat through poor conductor: Determine thermal conductivity of a poor conductor by Lee's method.
7. Experimental study of probability distribution for a two option system using a coloured dice.
8. Determination of velocity of sound, using CRO microphone, speakers by standing waves.
9. Study of dependence of Velocity of wave propagation on line parameters using torsional wave apparatus.
10. Study of variation of reflection coefficient with nature of termination using torsional wave apparatus.
11. Study of interference with two coherent sources of sound.
12. Determination of wave length of monochromatic light and refractive index of given liquid by Newton's ring.

1. Section B

1. Determination of principal points of a combination of lenses.
2. Use of diffraction grating, find '1' and its resolving power.
3. Determination of resolving power limit of resolution of a telescope and study of various eye pieces, (any two)
4. Polarisation of light by reflection verify Brewster's law &. law of Malus
5. Study of optical rotation of plane of polarization of sugar. Using polarimeter.
6. Study of interference of light with biprism and determine '1'.
7. Use of Michelson's interferometer and determine dl, '1' for sodium light.
8. Use of F.P. etalon to determine '1' for sodium light.
9. Study of laser as a monochromatic source with reference to interference.
10. Study of laser as a monochromatic source with reference to diffraction
11. Determination of dispersive power of prism material with the help of spectrometer. **Suggested Readings**

1. Principle of Optics by B K Mathur
2. Optics by D P Khandelwal
3. Introduction to modem optics by A K Ghatak (Tata McGraw Hill)
4. Optics by Brij Lai and Subramanium.
5. An Introduction to Modem Optics by G R Fowels
6. Optics Physics by Lipson and Lipson.
7. Essentials of Lasers by Allen.

CHEMISTRY

PAPER I INORGANIC CHEMISTRY

Paper Code; 02ABM 104   **Maximum Marks: 100**

External Marks: 70   **Internal Marks: 30**

UNIT I

Chemistry of Elements of First Transition Series

Characteristic properties of d-block elements. Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

Chemistry of Elements of Second and Third Transition series

General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii oxidation states, magnetic behaviour, spectral properties and stereochemistry.

UNIT II

Coordination Compounds

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

UNIT III

Chemistry of Lanthanide Elements

Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

Chemistry of Actinides

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides.

UNIT IV

Oxidation and Reduction

use of redox potential data-analysis of redox cycle, redox stability in water- Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements.

UNITY

Acids and Bases

Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases.

Non-aqueous Solvents

Physical properties of a solvent, types of solvents and their general characteristics reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

Suggested Readings

1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.
2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett, R.C. Denney, G.H. Heffery and J Mendham, ELBS.
3. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
4. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.
5. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, Academic Press.
6. Inorganic Syntheisis, McGraw Hill.
7. Experimental Organic Chemistry Vol. I&II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
8. Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.

PAPER II ORGANIC CHEMISTRY

Paper Code: 02ABM 105__   **Maximum   Marks: 100**

External Marks; 70__   **Internal Marks: 30**

UNIT I

Electromagnetic Spectrum: Absorption Spectra

Ultraviolet (UV) absorption spectroscopy- absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathchromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. Infrared (IR) absorption spectroscopy- molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds.

Ethers and Epoxides

Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions- cleavage and autoxidation, Ziesel's method. Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

UNIT II

Alcohols

Classification and nomenclature. Monohydric alcohols-nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic

nature. Reactions of alcohols. Dihydric alcohols-nomenclature, methods of formation ,chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacolpinacolone

rearrangement. Trihydiic alcohols- nomenclature and methods of formation, chemical reactions of glycerol.

Phenols

Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben- Hooesch reaction, Lederer-Manasse reaction and Reimeer-Tiemann reaction.

UNIT III

Carboxylic Acids

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids.Hydroxy acids: malic, tartaric and citric acids. Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents.

Carboxylic Acid Derivatives

Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substituion. Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms

of esterfication and hydrolysis (acidic and basic).

UNIT IV

Aldehydes and Ketones

Nomenclature and structure of carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acid. Physical properties.

Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Witting reaction. Mannich reaction. Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-kishner, LiAIH4 and NaBH4 reductions, Halogenation of enolizable ketones. An introduction to a,a unsaturated aldehydes and ketones.

UNITY

Organic Compounds of Nitrogen

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media Picric acid. Halonitroarenes: reactivity. Structure and nomenclature of amines, physical properties.Stereochemistry of amines. Separation of a mixture of primary, secondary and teritary amines. Structural features effecting basicity of amines. Amines salts as phase-transfer catalysts. Preparation of alkyl and aryl amines(reduction of nitro compounds, nitriles),reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hofmann bromamide

reaction. Reaction of amines, electrophilic aromatic substitution in aryl aminesreaction of amines with nitrous acid. Synthetic transformation of aryl diazonium salts, azo coupling.

Suggested Readings

1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.
1. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett, R.C. Denney, G.H. Heffery and J Mendham, ELBS.
2. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
3. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.
4. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, Academic Press.
5. Inorganic Syntheisis, McGraw Hill.
6. Experimental Organic Chemistry Vol. I&II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
7. Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.

PAPER III PHYSICAL CHEMISTRY

Paper Code: 02ABM 106   **Maximum Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT I

Thermodynamics-I

Definition of thermodynamic terms: system, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work. *First Law of Thermodynamics:* Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law-Joule-Thomson coefficient and inversion temperature. Calculation of w,q, dU, & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. *Thermochemistry:* standard state, standard enthalpy of formation-Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermochemical data, temperature dependence of enthalpy, Kirchhoff's equation.

UNIT II

Thermodynamics-II

Second law of thermodynamics: need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature. Concept of entropy: entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases. *Third law of thermodynamics*: Nemst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz functio(A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G with A with P, V and T.

UNIT III

Chemical Equilibrium

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chatelier's principle. Reaction isotherm and reaction isochore- Clapeyron equation and

Clausisus- Clapeyron equation, applications.

Phase Equilibrium

Statement and meaning of the terms- phase, component and degree of freedom, thermodynamic derivation of Gibbs phase rule, phase equilibria of one component system- water, CO_2 and S systems. Phase equilibria of two component system- solid-liquid equilibria, simple eutectic-Bi-

Cd, Pb-Ag systems, desilverisation of lead. Solid solutions- compound formation with congruent melting point (Mg- Zn) and incongruent melting point, (NaCl-H20), (FeC13-H20) and CuS04- H20)system. Freezing mixtures, acetone-dry ice. Liquid-liquid mixtures- ideal liquid mixtures, Raoult's an Henry's law. Non-ideal system-azeotropes- HC1-H20 and ethanol - water systems. Partially miscibl liquids-Phenol-water, trimethylamine, nicotine-water systems. Lower and upper consolute temperature. Effect of impurity on consolute temperature. Immiscible liquids, steam distillation. Nemst distribution law-thermodynamic derivation, applications.

pH Definition of pH and pKa determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods. Buffers-mechanism of buffer action, Henderson-Hazel equation. Hydrolysis of salts. mCorrosion-types, theories and methods of combating it.

UNIT IV

Electrochemistry-I

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch law, Arrehenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution

law its uses and limitations. Debye-Huckel-Onsagar's equation for strong electrolytes (elementary

treatment only). Transport number, definition and determination by Hittorf method and

moving boundary method. Applications of conductivity measurements: determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

UNITY

Electrochemistry-II

Types of reversible electrodes-gas-metal ion, metal-insoluble salt anion and redox electrodes. Electrode reactions, Nemst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode- reference electrodes-standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell and its measurements. Computation of cell EMF. Calculation of thermodynamic quantities of cell r
potential and hydrogen over voltage. Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

Suggested Readings

1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.
2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett, R.C. Denney, G.H. Heffery and J Mendham, ELBS.
3. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
4. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.
5. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, Academic Press.
6. Inorganic Syntheisis, McGraw Hill.
7. Experimental Organic Chemistry Vol. **I&n, P.R.** Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
8. Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.

CHEMISTRY PRACTICALS

Paper Code: 02ABM 202   **Maximum Marks: 100**

External Marks; 50   **Internal Marks: 50**

Inorganic Chemistry

(A) Calibration of fractional weights, pipettes and burettes. Preparation of

standard solutions. Dilution 0.1 M to 0.001 M solutions.

(B)   Quantitative Analysis

Volumetric Analysis (Any Four)

(i)   Determination of acetic acid in commercial vinegar using NaOH.

(ii)   Determination of alkali content-antacid tablet using HCI.

(iii) Estimation of calcium content in chalk as calcium oxalate by permanganometry.

(iv)   Estimation of hardness of water by EDTA.

(v)   Estimation of ferrous and ferric dichromate method.

(vi)   Estimation of copper using thiosulphate.

(C)   Gravimetric Analysis.

(i)   Analysis of Cu as CuSCN

(ii)   Ni as Ni-dimethylglyoxime.

Organic Chemistry

(A) Chromatography (Any Four)

(i)   Separation , Rf values and identification of organic compounds.

(ii)   Preparation and separation of 2,4-dinitrophenylhydrozone of acetone,2-

butanone, hexan-2- and 3-one using toluene and light petroleum (40:60:).

(iii) Separation of a mixture of dyes using cyclohexane and ethyl acetate(8.5:1.5)

(iv)   Separation of a mixture of phenylalanine and glycine. Alanine and aspartic acid. Leucine and glutamic acid. Spray reagent-ninhydrin.

(v)   Separation of a mixture of D,L- alanine, glycine and L-Leucine using nbutanol: acetic acid: water(4:l:5), spray reagent-ninhydrin.

(vi)   Separation of monosachharides- a mixture of D-galactose and D-fructose using n-butanol: acetone : water (4:5:1) spray reagent-aniline hydrogen phthalate.

(B) Qualitative Analysis

Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.

Physical Chemistry (Any Four)

1.   Determination of the transition temperature of the given substance by thermometric/dialometric method (e.g.MnC12,4H20/SrBr2. 2H20)

2.   To study the effect of a solute(e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system.

3.   To construct the phase diagram of two component (e.g. diphenylaminebenzophenone) system by cooling curve method.

4.   To determine the solubility of benzoic acid at different temperatures and to determin the dissolution process.

5.   To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weak base.

6.   To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Bom Haber cycle.

<u>**Suggested Readings**</u>

1.   Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.
2.   Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett, R.C. Denney, G.H. Heffery and J Mendham, ELBS.
3.   Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
4.   Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.
5.   Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, Academic Press.
6.   Inorganic Syntheisis, McGraw Hill.
7.   Experimental Organic Chemistry Vol. **I&n, P.R.** Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
8.   Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.
12.   Advanced Practical Physical Chemistry, Vol.I-Physical, J.B.Yadav,Goel Publishing House.
13.   Advanced Experimental Chemistry, Vol.I-Physical, J.N. Gurtu and R.Kapoor, S Chand & Co.
14.   Selected Experiments in Physical Chemistry, N.G. Mukherjee . J.N. Ghose & Sons.
15.   Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

MATHEMATICS

PAPER I - ADVANCED CALCULUS

Paper Code; 02ABM 107   **Maximum Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT -1

(Advanced Differential Calculus)

Definition of the limit of a function, Basic properties of limits, Continous functions and classification of discontinuities, Sequential Continuity, properties of continuous functions defined on closed intervals, Limit and Continuity of functions of two variables. Differentiability, Chain rule of differentiability. Mean Value Theorems and their geometrical interpretation, Darboux's intermediate value theorem for derivatives, Taylor's theorem for functions of two variables.

UNIT-II

(Advanced Integral Calculus)

Riemann integral, Integrability of continuous and monotonic functions. Darboux theorem, Fundamental theorem of integral calculus, Mean value theorems of integral calculus.

UNIT - III

Fourier series, Fourier expansion of piecewise monotonic functions, Uniform convergence of series of functions, Wirestrass M-test, Abel's test and Dirichlet's test.

UNIT - IV

Definition of a sequence, Theorems on limits of sequences, Bounded and monotonic sequences, Cauchy's convergence criterion, Infinite series of non-negative terms, its convergence.

UNIT-V

conditional Different tests of convergence of infinite series *i.e.* comparison tests, Cauchy's integral tests, Ratio tests, Raabe's test Logarithmic, Morgan and Bertrand's tests (without proof), Altenating series, Leibnitz's theorem, Absolute and convergence.

Suggested Readings

1. "Schaum's Outline of Advanced Calculus, Third Edition (Schaum's Outlines)" by Robert Wrede
2. http://www.math.harvard.edu/~shlomo/docs/Advanced_Calculus.pdf
3. Advanced Calculus (Revised Edition) Paperback - 12 Mar 2014 by Lynn Harold Loomis (Author), Shlomo Sternberg (Author), Susan Hood (Contributor)

PAPER II - DIFFERENTIAL EQUATIONS

Paper Code: 02ABM 108   **Maximum Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT -1

Differential equations of first order and first degree, linear differential equations, Bemoulle's equation, Exact differential equations.Differential equations of first order and higher degree;Clairauts form and singular solutions, geometrical interpretation of differential equations, Linear differential equations with constant coefficients, Ordinary homogeneous linear differential equations.

UNIT - II

Linear differential equations of second order, Normal Form, changing the independent variable. Methods of variation of parameters and of operator factors. Simultaneous differential equations, Total differential equations, Exact differential equations of nth order, Riccati's equations, Existence and uniqueness theorems.

UNIT - III

Series solution of differential equations, Power series method, Bessel, Legendre, and Hypergeometric equations.

UNIT - IV

Partial differential equations of the first order, Lagrange's solution, Some special type of equations which can be solved easily by methods other than the general method, Charpit's general method of solutions.

UNIT-V

Partial differential equations of second and higher orders, Classification of linear Partial differential equations of second order, Homogeneous and Nonhomogeneous equations with constant coefficients.

Suggested Readings

1. "Essentials of Ordinary Differential Equations" by R P Agarwal and R Gupta
2. "Differential Equations and their Applications" by M Braun
3. "Theory of Ordinary Differential Equations" by E A Coddington and N Levinson
4. "Differential Equations and Dynamical Systems" by L Perko
5. "Ordinary Differential Equations" by Morris Tenenbaum and Harry Pollard
6. "An Introduction to Ordinary Differential Equations" by Earl A Coddington and Mathematics

PAPER III - MECHANICS

Paper Code: 02ABM 109   **Maximum Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT -1

Analytical conditions of equlibrium of coplanar forces, Friction, Virtual work.

UNIT-II

Common Catenary , Forces in three dimensions, Poinsot's central axis, Stable and unstable equilibrium.

UNIT - III

Velocities and Accelerations along radial and transverse directions, and along tangential and normal directions, Simple Harmonic Motion, Rectilinear motion under variable laws.

UNIT - IV

Hook's law, related problems on horizontal and vertical elastic string , Motion in resisting medium.

UNIT - V

Constrained motion on smooth plane curves (Circular and Cycloidal Motion). Impact (Direct and Oblique). Central orbits, *p - r* equation, Apses, Time in an orbit, Kepler's laws of planetary motion.

Suggested Readings

1. "Introduction to Solid Mechanics" by IH Shames
2. "Vector Mechanics for Engineers: Dynamics" by F P Beer and Jhonston
3. "Vector Mechanics for Engineers: Statics" by David Mazurek and Ferdinand Johnston Beer
4. "Mechanics of Materials For Dummies" by James H Allen III
5. "Engineering Mechanics Statics and Dynamics" by N H Dubey

STRATIGRAPHY AND PALAEONTOLOGY Paper Code: 02ABM

A. STRATIGRAPHY

UNIT I.

Scope and basic principles.- Local section - Type area and Type section strata, Breaks in stratigraphic succession -Unconformities-general nature and types of unconformities -Nonsequences, Diastem,hiatus and their significance. Overlap and offlap

UNIT II.

Elements of lithostratigraphic, chronostratigraphic and biostratigraphic classifications and their units. A brief study of the modem trends in stratigraphic classification, stratotypes and type area.

UNIT III.

Geological time scale and time units. Stratigraphic concepts of correlation, criteria and methods. **B.**

PALAEONTOLOGY

UNIT IV.

Scope and sub-divisions of palaeontology. Fossilisation requisites and methods, Types of fossils and their concept- Index fossils , Body fossils, trace fossils and zone fossils.Transported and leaked fossils. Synthetic fossils and Pseudo fossils.

UNITV

Classification and nomenclature of fossils, basic principles of taxonomy and systematics. Binomial nomenclature, type specimens and kinds (Holotype, Genotype, Paratype and Plastotype). Scientific values and uses of fossils.

UNIT VI

Morphological features, classification and stratigraphic distribution of the following: Phylum Protozoa -Order: Foraminifera Phylum Coelenterata-Class :Anthozoa

UNIT VII

Phylum : Brachiopoda Sub Phylum Hemichordata- Class :Graptolithina

Phylum Mollusca -Class Pelecypoda, Class Gastropoda,Class Cephalopoda.

UNIT IX

Phylum Arthropoda -Class Trilobita Phylum Echinodermata-Class: Crinoidea, Class: Echinoidea

UNIT X.

A brief study of the following plant fossils of India. Glossopteris, Gangamopteris, Ptilophyllum,Williamsonia, Sigillaria, Calamites, Lepidodendron, Introduction to vertebrate fossils

Suggested Readings

1. Paper I Physical Geology and Geomorphology
2. BLOOM A.L. (1992): Geomorphology, Second Edition, Prentice Hall India Pvt.Ltd., New Delhi.
3. HOLMES A.(1981): Principles of Physical Geology. ELBS, Third Edition.
4. GILLULYJ.,WATERS A.C. and WOODFORD A.C.(1975) Principles of Geology, Fourth Edition, W.H. Freeman and Co., 9
5. JUDSON S. and KAUFFMAN M.E.(1990)Physical Geology Eighth Edition, Prentie Hall, New Jersey.
6. MCALISTER,A.L.and HAY, E.A.(1975)Physical Geology, Principles and Perspectives. Prentice Hall Inc. London.
7. MATHUR, Physical Geography. National Book Trust, New Delhi.
8. MISHRA, Rivers of India. National Book Trust, New Delhi.
9. MONTGOMERY C.W.(1993) Physical Geology. Wn. C.Brown Publishers, IOWA.
10. SKINNER B J. and PORTER S.C.(1987). Physical Geology, John Wiley and Sons, New York.

STRUCTURAL GEOLOGY AND GEOTECTONICS

Paper Code: 02ABM 111   **Maximum   Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT I

Stratification, dip, strike, apparent dip, outcrop. Factors controlling pattern and width of outcrops. Outlier, Inlier. Rule of V's, simple problems involving dip, apparent dip , thickness of beds and width of outcrops. Use of clinometer and Brunton compass. Rock deformation-stress and strain. Stages of rock deformation Factors controlling rock deformation

UNIT II

Folds-Geometry and elements of folded surface. Geometric classification of folds. Recognition of folds in field and on maps.

UNIT III

Faults: Terminology, classification, Mechanics of faulting, criteria for recognition of faults in the field and on maps.

UNIT IV

Joints: Nature,origin and classifications.Unconformities and their recognition in the field and on maps.

UNITV

Foliations and lineations-introduction, mode of occurrence.

UNIT VI

Topographic methods of representation- contour , topographic maps, geological maps, conventional map and rock symbols. Interpretation of geological maps.

UNIT VII

Origin of Mountains- structure and classification Theory of orogeny .Mobile Belt Alpine Himalayan Orogeny. Isostasy.

UNIT VIII

Major structural features of earth-shield, craton, platform, mid ocean ridge system, deep sea trenches, island arcs, fracture systems, geosynclines hot spots, mantle plumes.

UNIT IX

Outline study of global tectonics.Concepts of global tectonics.Continental Drift Convection Current Hypothesis.Modem tectonic hypothesis- Sea floor spreading,

UNIT X

Plate tectonics- Evolution of the concept, types of plates and boundaries, triple junctions, mechanism of plate movements. Polar reversals, Palaeomagnetism.

Suggested Readings

1. Paper I Physical Geology and Geomorphology
2. BLOOM A.L. (1992): Geomorphology, Second Edition, Prentice Hall India Pvt.Ltd., New Delhi.
3. HOLMES A.(1981): Principles of Physical Geology. ELBS, Third Edition.
4. GILLULY,J.,WATERS A.C. and WOODFORD A.C.(1975) Principles of Geology, Fourth Edition, W.H. Freeman and Co., 9
5. JUDSON S. and KAUFFMAN M.E.(1990)Physical Geology Eighth Edition, Prentie Hall, New Jersey.
6. MCALISTER,A.L.and HAY, E.A.(1975)Physical Geology, Principles and Perspectives. Prentice Hall Inc. London.
7. MATHUR, Physical Geography. National Book Trust, New Delhi.
8. MISHRA, Rivers of India. National Book Trust, New Delhi.
9. MONTGOMERY C.W.(1993) Physical Geology. Wn. C.Brown Publishers, IOWA.
10. SKINNER B J. and PORTER S.C.(1987). Physical Geology, John Wiley and Sons, New York

PRACTICAL II - PALAEONTOLOGY, ECONOMIC GEOLOGY AND STRUCTURAL GEOLOGY

Paper Code: 02ABM 203   **Maximum Marks: 100**

External Marks; 50   **Internal Marks:50**

Palaeontology Sketching the following fossils with description, taxonomic position, strtigraphic range and representation in Indian strata. Protozoa- Textularia, Globigerina, Lagena, Nummulites, Nodosaria, Coelenterata- Zaphrentis, Lithostrotion, Calceola, Syringopora, Halysites, Favosites,

Holiolites, Montlivaltia, Isastria, The cosmilia. Brachiopoda- Lingula, Orthis, Terebratula, Pentamerus, Rhynchonella, Productus, Strophomena, Atrypa, Athyris, Spirifer,

Pelecypoda: Nucula, Glycimeris, Arca,Trigonia Unio. Spondylus, Pecten.

Inoceramus, Ostraea, Gryphaea, Alectryonia, Exogyra and Hippurites Gastropods- Bellerophon, Pleurotomaria, Cerithium, Turritella, Conus, Murex, Physa, Trochus, Cypraea Cephalopoda- Orthoceras, Nautilus, Goniatites, Tropites, Macrocephalites, Persphinctes, Phylloceras, Schloenbachia Trilobita - Olenellus, Phacops, Calymene, Paradoxides, Olenus, Agnostus,

Echinoderms-Crinoidea-Apiocrinus, Pentacrinus, Encrinus Echinoidea, Cidaris, Hemicidaris, Holaster, Micraster Hemichordata-Monograptus, Didymograptus, Phyllograptus, Rastrites,Tetragraptus Plant fossils-Lepidodendron, Sigillaria, Calamites, Glossopteris, Gangamopteris, Ptilophyllum, Taeniopteris, Williamsonia

B- Economic Geology- Identification of important ores and economic minerals

C- Structural Geology- Interpretation of simple geological maps and preparation of sections. Simple problems in structural geology.

D- Fieldwork and collection of specimens: study of geological formations, collection of rocks, minerals and fossils and field trips to places of geological importance in India will form an integral part of the course for all the three years.

Suggested Readings

1. Paper I Physical Geology and Geomorphology
2. BLOOM A.L. (1992): Geomorphology, Second Edition, Prentice Hall India Pvt.Ltd., New Delhi.
3. HOLMES A.(1981): Principles of Physical Geology. ELBS, Third Edition.
4. GILLULY,J.,WATERS A.C. and WOODFORD A.C.(1975) Principles of Geology, Fourth Edition, W.H. Freeman and Co., 9
5. JUDSON S. and KAUFFMAN M.E.(1990)Physical Geology Eighth Edition, Prentie Hall, New Jersey.
6. MCALISTER,A.L.and HAY, E.A.(1975)Physical Geology, Principles and Perspectives. Prentice Hall Inc. London.
7. MATHUR, Physical Geography. National Book Trust, New Delhi.
8. MISHRA, Rivers of India. National Book Trust, New Delhi.
9. MONTGOMERY C.W.(1993) Physical Geology. Wn. C.Brown Publishers, IOWA.
10. SKINNER B.J. and PORTER S.C.(1987). Physical Geology, John Wiley and Sons, New York.
ll.STRAHLER, A.N.(1971)Earth Sciences, Second Edition, Harper and Row. 11 Paper II Crystilography and Mineralogy
12. BABU S.K. and SINHA D.K.(1987)Practical Manual of Crystal Optics, CBS Publications, Delhi.
13. BERRY L.G. MASON,B and DEITRICH R.V.(1985). Mineralogy. CBS Publications, Delhi.
14. BLACKBURN W.H. and DENNEN W.H.(1990).Principles of Mineralogy, Universal Book Stall, New Delhi.

PART m

PHYSICS

PAPER-I QUANTUM MECHANICS AND SPECTROSCOPY

Paper Code; 03ABM 101   **Maximum   Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT I

Origin of Quantum theory: Failure of classical Physics to explain the phenomenon such as black body spectrum, Planck's radiation law, photoelectric effect and Einstein explanation, Compto Effect deBroglie hypothesis, evidence for diffraction and interference of particles. Uncertainty principle and its consequences gamma ray microscope, diffraction at a single slit, Application of uncertainty principle, (i) Non existence of electron in nucleus, (ii) Ground state energy of H-atom (iii) Ground state energy of harmonic oscillator, Energy-time uncertainty.

UNIT II

Schrodinger equation - time dependent and time independent form, Physical significance of the wave function and its interpretation, prob4 ability current density, operators in quantum mechanics, Unear and Hermitian operators, Expectation values of dynamical variables, the position, momentum, energy, fundamental postulates of quantum mechanics, eigen function and eigen value, degeneracy , orthogonality of eigen functions, commutation relations . Ehrenfest theorem, concept of group and phase velocities, wave packet.

UNIT III

Simple Solutions of Schrodinger equation : Time independent Schrodinger equation and stationary state solution, Boundary and continuity conditions on the wave function, particle in on dimensional box, eigen function and eigen values , discrete energy levels, extension of results for three dimensional case and degeneracy of levels. Potential step and rectangular potential barrier , calculation of reflection and transmission coefficient, Quahtative discussion of the application to alpha decay(tunnel effect), square well potential problem, calculation of transmission coefficient.

UNIT IV

Bound State Problems : Particle in one dimensional infinite potential well and finite depth potential well, energy value and eigen functions, simple harmonic oscillator (one dimensional) eigen function, energy eigen values, zero point energy. Schrodinger equation for a spherically symmetric potential, Separation of variables, Orbital angular momentum and its quantisation, spherical harmonics, energy levels of H-atom, shape of n=l, n=2 wave functions, comparison with Bohr model and Correspondence principle.

Elementary Spectroscopy : Quantum features of one electron atoms, Frank-Hertz experiment and discrete energy states, Stem and Gerlach experiment, Spin and Magnetic moment, Spin Orbit coupling and qualitative explanation of fine structure. Atoms in a magnetic field, Zeeman effect, Zeeman splitting. Qualitative features of molecular spectroscopy, Rigid rotator, discussion of energy eigenvalues and eigenfunctions, Rotational energy levels of diatomic molecules, Rotational spectra, Vibrational energy levels of diatomic molecules, Vibrational spectra, Vibrational Rotational spectra, Raman effect.

Suggested Readings

1. H. S. Mani and G.K.Mehta, Introduction to modem Physics, (Affl. East West Pressl989)

2. A. Beiser, Prospective of modem Physics

3. H.E. White, Introduction to Atomic Physics.

4. Barrow, Introduction to Molecular Physics.

5. D.P.Khandelwal, Optics and Atomic Physics (Himalaya Pub. House Mumbai 1988)

PAPER - II NUCLEAR PHYSICS

UNIT-I

Nuclear Properties : Rutherford's Theory of a Particle Scattering, Properties of Nuclei : Quadrupole Moment and Nuclear Ellipticity, Quadrupole Moment and Nuclear Spin, Parity and Orbital Angulr Momentum, Parity and Its Conservation, Nuclear Mass and Mass Spectroscopy,

Nuclear Energy, Explanation of the fact that Electrons Cannot Exist within a Nucleus, Discovery of Neutron and Proton-Neutron Hypothesis, Neutron to Proton Ratio (N/Z), The Nuclear Potential, Nuclear Mass, Atomic Mass Unit (a.m.u.), Mass Defect and Binding Energy, Nuclear Forces, Theory of Nuclear Forces, The Liquid Drop Model.

UNIT-II

Nuclear Fission : The Discovery of Nuclear Fission, The Energy Release In Fission, The Fission products, Mass Distribution of Fission Products, Fission Cross Section and Threshold, Neutron Emission In Fission, The Prompt Neutron and Delayed Neutrons, Energy of Fission Neutrons, Theory of Nuclear Fission and Liquid Drop Model, Barrier Penteration-Theory of Spontaneous Fission, Nuclear Energy Sources, Nuclear Fission as a Source of Energy, The Nuclear Chain Reaction, Condition of Controlled Chain Reaction, The Principle of Nuclear Reactors, Classification of Reactors, Typical Reactors, Power of Nuclear Reactors, Critical size of Thermal Reactors, The Breeder Reactors, Reprocessing of the Spent Fuel, Radiation Damages and Fission Products Poisoning, Uses of Atomic Energy.

UNIT-III

Nuclear Fusion : The Sources of Stellar Energy, The Plasma : The Fourth State of The Matter, Fusion Reaction, Energy Balance and Lawson Criterion, Magnetic Confinement of Plasma, Classical Plasma Losses from the Magnetic Container, Anomalous Losses, Turbulence and Plasma Instabilities, The Laser Fusion Problem, Fusion Reactor.

Elementary Particles : Classification of Elementary Particles, Fundamental Interactions, Unified Approch (Basic ideas), The Conservation Laws, Quarks (Basic ideas), Charmed and Colou Quarks.

UNIT-IV

Accelerators : Ion Sources. CockCroft-Walten High Voltage Generators, VanDeGraff Generators, Drift Tube Linear Accelerators, Wave Guide Accelerator, Magnetic Focusing in Cyclotron, Synchrocyclotron, Betatron : The Electromagnetic Induction Accelerator, Electron Synchrotron, Proton Synchrotron.

Particle and Radiation Detectors : Ionisation Chamber, Region of Multiplicative Operation, Proportion Counter, Geiger-Muller Counter, Scintillation counter, Cloud Chamber.

Cosmic Rays : Discovery of Cosmic Rays, Nature of Cosmic Rays, soft and hard, components, variation in cosmic rays—

(1)   Latitude Effect

(2)   East-West Asymmetry or Directional Effect

(3)   Altitude Effect

Detection of Cosmic Ray Particles, Origin of Cosmic Rays.

Suggested Readings

1.   H. S. Mani and G.K.Mehta, Introduction to modem Physics, (Affl. East West Pressl989)

2.   A. Beiser, Prospective of modem Physics

3.   H.A.Enge, Introduction to Nuclear Physics.

PAPER - III SOLID STATE PHYSICS

Paper Code: 03ABM 103   **Maximum Marks: 100**

External Marks; 70   **Internal Marks; 30**

UNIT-I

Crystal Binding and Crystal Structure: Crystal Bonding, Ionic Bond, Binding Energy of Ionic Crystal, Determination of the Repulsive Exponent, Covalent Bonding, Metallic Bonding, Molecular or Vander Waal's Bonding, Hydrogen Bonding. Space Lattice and Crystal Structure, Bravis

Lattice, Miller Indices and Crystal Structure, Spacing of Planes in Crystal Lattice, Atomic packing, Simple Cubical L attice Structure, Face Centered Cubic Lattice Structure, Body Centered Cubic Lattice Structure, Hexagonal Closed Packed Structure, Pervoskite Structure, X- ray Diffraction and Bragg's Law, Laue equation of X-ray diffraction.

UNIT-II

Thermal Properties of the Solids : Concepts of Thermal Energy and Phonons, Internal Energy and Specific Heat, The Various Theories of Lattice Specific Heat of Solids: The Einstein Model, Vibrational Modes of Continuous medium, Debye Model, Electronic Contribution of the

internal Energy hence to the Specific Heat of Metals, Thermal Conductivity of the lattice.

UNIT-III

Band Theory of Solids : Formation of Bands, Periodic Potential of a Solid, Wave Function in a Periodic Lattice and Bloch Theorem, Number of States in a Band, Kronig Penny Model, Velocity of the Bloch electrons and Dynamical Effective Mass, Momentum, Crystal Momentum and Physical Origin of the Effective Mass, Negative Effective Mass and concept of Holes, The distinction between metals, insulators, and intrinsic semiconductors.

UNIT-IV

Electrical Conductivity : Drude-Lorentz Theory of Electrical Conductivity, Boltzmann Transport Equation, Sommerfield Theory of Electrical Conductivity, Mathiessen's Rule, Thermal Conductivity and Wildemann- Franz's Law, The Hall Effect.

Superconductivity : Introduction, Experimental Features of Superconductivity, The Isotope Effect and Electron-Phonon Interaction, The Effect of the Superconducting Transition on Properties of superconductors, Special Features of Superconducting Materials, Theoretical Survey (Basic Ideas), Flux Quantisation, BCS Theory of Superconductivity: Cooper Pairs, High Temperature Superconductors (Basic Ideas)

UNIT-V

Magnetic Properties : Classification of Magnetic Materials, Origin of Atomic Magnetism, Dynamics of Classical Dipole In Magnetic Field, Magnetic Susceptibility, phenomenon of Diamagnetism, Para magnetism susceptibility of Ionic Crystal, Ferromagnetism, Temperature Dependence of Saturation of Spontaneous Magnetization, The Paramagnetic Region, The Nature of Ferromagnetism, Nature and Origin of Weiss Molecular Field, Heisenberg's Exchange Interaction, (Quantum Theory of Ferromagnetism), Relation Between Exchange Integral and Weiss Constant, Ferromagnetism Domains, Magnetostriction.

Suggested Readings

1. C Kittel, Introduction to Solid State Physics.

2. J.S.Blackmore, Solid State Physics(Cambridge Univ. Press)

3. H.C. Gupta, Solid state Physics, Vikas Publication, Delhi.

4. R. L. Singhal, Solid state Physics, Kedar Nath Publication, Meerut.

PHYSICS PRACTICALS

Paper Code: 03ABM 201   **Maximum Marks: 100**

External Marks;50   **Internal Marks; 50**

Group: A

1. Determination of Planck's constant by photo-cell (retarding potential method using optical

    filters. Preferably five filters).

2. Determination of Planck's constant using solar cell.

3. Determination of Stefan's constant.

4. Study of the temperature dependence of resistance of semi-conductor (four-probe method).

5. Study of iodine spectrum with the help of grating and spectrometer using ordinary bulb light.

6. Study of the characteristics of a G M counter and verification of inverse square law for the
    same strength of a radioactive source.

7. Study of absorption in a foil using G M counter.

8. To find the magnetic susceptibility of paramagnetic solution using Quinck's method. Also find
    the ionic molecular susceptibility of the ion and magnetic moment of the ion in terms of Bohr magneton.

9. Determination of coefficient of rigidity as a function of temperature using torsional oscillators
    (resonance method).

10. Study of polarization by reflection from a glass plate with the help of Nicol prism and photo cell and
    verification of Brewsters law and law of Malus.

11. e/ m measurement by Helical method.

12. Measurement of magnetic field using ballistic galvanometer and search coil study of variation of
    magnetic field of an electro magnet with current.

13. Measurement of electronic charge by Millikan's oil drop method.

Group: B

1. Study of a R-C transmission line at 50 Hz.

2. Study of a L-C transmission line

    (i)   at fixed frequency.

    (ii) at variable frequency.

3. Study of resonance in an LCR circuit (using air core inductance and damping bymetal plate):

(i)   at fixed frequency by varying C, and

(ii)   by varying frequency

4.   (i) Recovery time of junction diode and point contact diode.

(ii) Recovery time as a function of frequency of operation and switching.

5.   Design a zener regulation with various loads.

6.   Study the characteristics of field effect transistor (FET) and design and study amplifier of finite gain.

7.   Study the frequency response of transistor amplifier and measure the input and output impedances (frequency response with change of values of R and C components).

8.   Design and study of an R-C phase shift oscillator.

9.   Study voltage multiplier circuit to generate high voltage D.C. from A.C.

10. Using discrete components, study OR, AND, NOT logic gates, compare with TTL integrated circuits IC's.

11.   Application of operational amplifier (OP-AMP) as : (Minimum Two of the

following exercise)—

(i) Inverter (ii) Non-Inverter

(iii)   Differentiator (iv) Integrator.

Suggested Readings

1.   Raj Kumar practical Physics.
2.   Dr. S.P. Singh practical Physics.
3.   Dr. V.P. Arora Advance practical Physics.
4.   Practical Physics by CBH Jaipur.
5.   Practical Physics by RBD Jaipur.
4.   H.E. "White, Introduction to Atomic Physics.
5.   Barrow, Introduction to Molecular Physics.
6.   D.P. Khandelwal, Optics and Atomic Physics (Himalaya Pub. House Mumbai 1988)
1.   H. S. Mani and G.K.Mehta, Introduction to modem Physics, (Affl. East West Pressl989)
2.   A. Beiser, Prospective of modem Physics
3.   H.A.Enge, Introduction to Nuclear Physics.

CHEMISTRY

PAPER-I INORGANIC CHEMISTRY

Paper Code; 03ABM 104   **Maximum Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT-I

Metal-ligand Bonding in Transition Metal Complexes

Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral , tetrahedral and square planar complexes, factors affecting the crystal- field parameters.

Thermodynamic and Kinetic Aspect of Metal Complexes

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar and octahedral complexes.

UNIT-II

Magnetic Properties of Transition Metal Complexes

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of is and ieff values, orbital contribution to magnetic moments, application of magnetic moment data

Electronic Spectra of Transition Metal Complexes

Types of electronic transition, selection rules of d-d transitions, spectroscopic ground state, spectrochemical series. Orgel-energy level diagram for dland d9 states, discussion of the electronic spectrum of $[Ti(H2O)6]3+$ complexion.

UNIT-III

Organometallic Chemistry

Definition, nomenclature and classification of organometallic compounds.Preparation, properties, bonding and applications of alkyls and aryls of Li, Al,Hg, Sn and Ti, a brief account of metal-ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

UNIT-IV

Basics of Bioinorganic Chemistry

Essential and trace elements in biological processes, metallporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to $Ca2+$. Nitrogen fixation.

UNIT-V

Hard and Soft Acids and Bases(HSAB)

Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

Silicones and Phosphazenes

Silicones and phosphazenes as examples of organic polymers, nature of bonding in triphosphazenes.

Suggested Readings

1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.
2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett,
1. R.C. Denney, G.H. Heffery and J Mendham, ELBS.
2. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
3. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.
4. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, AcademicPress.
5. Inorganic Syntheisis, McGraw Hill.
6. Experimental Organic Chemistry Vol. I&II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
7. Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.
8. Vogel's Textbook of Practical Organic Chemistry, B.S. Fumiss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
9. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal,East- West press.
10. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw hill.

PAPER-II ORGANIC CHEMISTRY

Paper Code: 03ABM 105   **Maximum Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT-I

Spectroscopy Nuclear Magnetic resonance (NMR) spectroscopy.

Proton magnetic resonance(lH NMR) spectroscopy, nuclear shielding and dishielding chemica shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2,- tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

UNIT-II

Organometallic Compounds

Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reaction.

Organozinc compounds:formation and chemical reactions. Organolithium compounds: formation and chemical reactions.

Fats, Oil and DetergentsNatural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates.

UNIT-III

Organic Synthesis via Enolates

Acidity of a-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethy acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate.Alkylation of 1,3-dithianes. Alkylation and acylation of enamines.

UNIT-IV

Carbohydrates

Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erithro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters, Determination of ring size of monosaccharides.

Cyclic structure of D(+)- glucose. Mechanism of mutarotation. Structure of ribose and deoxyribose.

An introduction to disacchaiides(maltose, sucrose and lactose) and polysaccharides(starch and cellulose) without involving structure determination.

Amino Acids, Peptides, Proteins and Nucleic Acids

Classification, structure and stereochemistry of amino acids. Acid base behavior, isoelectric point and electrophoresis. Preparation and reactions of aamino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structures of peptides and proteins, level of protein structure. Proteins denaturation/ renaturation. Nucleic acids: introduction, Constitution of nucleic acids. Ribnonucleosides and ribonucleotides. The double helical structure of DNA.

UNIT-V

Synthetic Polymers

Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

Synthetic Dyes

Colour and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and indigo.

Suggested Readings

1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.
2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett,
1. R.C. Denney, G.H. Heffery and J Mendham, ELBS.
2. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
3. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.
4. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, AcademicPress.
5. Inorganic Syntheisis, McGraw Hill.
6. Experimental Organic Chemistry Vol. I&II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
7. Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.
8. Vogel's Textbook of Practical Organic Chemistry, B.S. Fumiss, AJ. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
9. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal,East- West press.
10. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw hill.
11. Advanced Practical Physical Chemistry, Vol.I-Physical, J.B.Yadav,Goel Publishing House.
12. Advanced Experimental Chemistry, Vol.I-Physical, J.N. Gurtu and R.Kapoor, S Chand & Co.
13. Selected Experiments in Physical Chemistry, N.G. Mukheqee . J.N. Ghose & Sons.
14. Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

Paper Code: 03ABM 106   Maximum Marks: 100

External Marks; 70   Internal Marks: 30

UNIT-I

Elementary Quantum Mechanics

Black-body radiation, Planck's radiation law, photoelectric effect, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect, de Brogile hypothesis, the Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates, of quantum mechanics, particle in a one dimensional box. Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

UNIT-II

Molecular orbital theory

Basic ideas- criteria for forming M.O from A.O, construction of M.O's by LCAO-H2 + ion, calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of 6, 6*,5, 9* orbitals and their characteristics. Hybrid orbitals-sp, sp2, sp3, calculation of coefficients of A.O.'s used in these hybrid orbitals. Introduction to valence bond model of H2, comparison of M.O. and V.B. models.

UNIT-III

Spectroscopy

Introduction : electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Bom-Oppenheimer approximation, degrees of freedom.

Rotational Spectrum

Diatomic molecules, Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.

Vibrational Spectrum

Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups. Raman Spectrum concept of polarizability, pure rotational and pure vibrational Raman Spectra of diatomic molecules, selection rules.

<div align="center">

UNIT-IV

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Electronic Spectrum

Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Frank-Condon principle. Qualitative description of 6, 9- and n M.O., their energy levels and the respective transitions.

Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus-Drapper law, Stark- Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluroscence, phosphorescence, nonradiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions- energy transfer processes (simple examples)

<div align="center">

UNIT-V

</div>

Solutions, Dilute Solutions and Colligative Properties

Ideal and non-ideal solutions, methods of expressing concentration of solutions, activity and activity coefficient. Dilute solution, colligative properties, Raoult's law, relative lowering of

vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

Suggested Readings

1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.
2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett,
1. R.C. Denney, G.H. Heffery and J Mendham, ELBS.
2. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
3. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.
4. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, AcademicPress.
5. Inorganic Syntheisis, McGraw Hill.
6. Experimental Organic Chemistry Vol. I&II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
7. Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.
8. Vogel's Textbook of Practical Organic Chemistry, B.S. Fumiss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
9. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal,East- West press.
10. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw hill.
11. Advanced Practical Physical Chemistry, Vol.I-Physical, J.B.Yadav,Goel Publishing House.
12. Advanced Experimental Chemistry, Vol.I-Physical, J.N. Gurtu and R.Kapoor, S Chand & Co.
13. Selected Experiments in Physical Chemistry, N.G. Mukherjee . J.N. Ghose & Sons.
14. Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

CHEMISTRY PRACTICALS

Paper Code: 03ABM 202   **Maximum Marks: 100**

External Marks; 70   **Internal Marks: 30**

(A)   Instrumentation

Colorimetry

(a) Job's method (b) Mole-ratio method Adulteration- Food stuffs. Effluent analysis, water analysis.

OR

Solvent Extraction: Separation and estimation of Mg(II) and Fe(II)

Ion Exchange Method: Separation and estimation of Mg(II) and Zn(II).

(B)   Synthesis of (Any six)

(a)   Sodium trioxalato ferrate (III), $Na_3[Fe(C_2O_4)_3]$

(b)   Ni-DMG complex,$[Ni(DMG)_2]$

(c)   Copper tetrammine complex $[Cu(NH_3)_4]SO_4$.

(d)   Cis-and trans-bisoxalato diaqua chromate (III) ion.

(f)   p-nitroacetanilide

(g)   p-bromoacetanilide

(h)   2,4,6- tribromophenol

(i)   Methyl orange

(j)   Methyl red

(k)   Benzoic Acid

(l)   Aniline

(m)   m-nitroaniline
(C)   Organic Qualitative Analysis

Analysis of an organic mixture containing two solid components using water, $NaHCO_3$, NaOH for separation and preparation of suitable derivatives.

(D) Laboratory Techniques

Steam Distillation

Naphthalene from its suspension in water

Clove Oil from cloves, Separation of o-and-p-nitrophenols

<div align="center">OR</div>

Column Chromatography,Separation of fluorescene and methylene blue, Separation of leaf

pigments from spinach leaves, Resolution of racemic mixture of ($\pm$) mandelic acid

<div align="center">OR</div>

Stereochemical Study of Organic Compounds via Models

(i)   R and S configuration of optical isomers.

(ii)   E,Z configuration of geometrical isomers.

(iii)   Conformational analysis of cyclohexane and substituted cyclohexanes.

(E)   PHYSICAL CHEMISTRY (ANY SIX)
1.   To determine the strength of the given acid conductometrically using standard alkali solution.
2.   To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.
3.   To study the saponification of ethyl acetate conductometrically
4.   To determine the ionisation constant of a weak acid conductometrically.
5.   To titrate potentiometrically the given ferrous ammonium sulphate solution using $KMnO_4/K_2Cr_2O_7$ as titrant and calculate the redox potential of Fe^{++}/Fe^{+++} system on the hydrogen scale.
6.   To verify law of refraction of mixtures (e.g. of glycerol and water) using Abbe's refractometer.
7.   To determine the specific rotation of a given optically active compound
8.   Determination of molecular weight of a non-violatile solute by Rast method/ Backmann freezing point method.
9.   Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebullioscopy.
10.   To verify Beer-Lambert law for $KMnO_4/K_2Cr_2O_7$ and determine the concentration of the given solution of the substance.

Books Suggested (Laboratory Courses)

1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.
2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett,
1. R.C. Denney, G.H. Heffery and J Mendham, ELBS.
2. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.
3. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.
4. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, AcademicPress.
5. Inorganic Syntheisis, McGraw Hill.
6. Experimental Organic Chemistry Vol. I&II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
7. Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.
8. Vogel's Textbook of Practical Organic Chemistry, B.S. Fumiss, AJ. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
9. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal,East- West press.
10. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw hill.
11. Advanced Practical Physical Chemistry, Vol.I-Physical, J.B.Yadav,Goel Publishing House.
12. Advanced Experimental Chemistry, Vol.I-Physical, J.N. Gurtu and R.Kapoor, S Chand & Co.
13. Selected Experiments in Physical Chemistry, N.G. Mukherjee . J.N. Ghose & Sons.
14. Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

MATHEMATICS

PAPER I - ABSTRACT ALGEBRA

Paper Code; 03ABM 107   **Maximum Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT -1

Ring, Examples of Rings, Ring with unity, Zero divisors, Integral Domain and Fields, their examples and properties. Characteristic of a ring and intergral domain. Subrings, subfields, Prime filed, Ring homomorphism, Embedding of Rings, Field of quotients of an integral domain.

UNIT - II

Ideals and their properties. Principal ideal and principal ideal ring, Prime ideal, Maximal ideal. Ideals and Quotient rings, Euclidean rings, Unique Factorisation Domain, Polynomial rings, Remainder theorem, Factor theorem, Polynomials over the rational fields.

UNIT - III

Vector Spaces : Definition and examples of a vector spaces, subspaces, Sum and direct sum of subspaces, linear span, linear Dependence, Independence and their basic properties, Basis, finite dimensional vector spaces, Existence theorem for basis, invariance of the number of elements of a basis set, Dimension, existence of complimentary subspace of a subspace of a finite dimensional vector space, dimension of sums of subspaces, quotient space and its dimension.

UNIT - IV

Linear transformations : Linear Transformations and their representation as matrices, the algebra of linear transformations, Syllaster Law of Nullity. Change of basis, Dual space, Dual Basis, Bidual space, Adjoint of a linear transformation, Annihilator of a sub space.

UNIT - V

Eigenvalues and Eigenvectors, Similar matrices, equivalent matrices,Similarity of Linear transformations, Reduction to triangular form, Minimal Polynomial. Diagonalisation of Matrices.

Suggested Readings

1. "Topics in Algebra" by IN Herstein
2. "Basic Abstract Algebra" by P B Bhattacharya
3. "Algebra" by Vivek Sahai and Vikas Bist
4. "Fundamentals of Abstract Algebra" by D S Malik
5. "HIGHER ALGEBRA" by Hall and Knight
6. "Algebra" by Artin
7. "Algebra For Beginners" by Hall and Knight
8. "Contemporary Abstract Algebra" by Joseph A Gallian

PAPER II - ANALYSIS

Paper Code: 03ABM 108   **Maximum   Marks: 100**

External Marks; 70   **Internal Marks: 30**

UNIT -1

Real Number System as a complete Ordered Field. The point set theory, Open and Closed sets, Limit point of a set, Neighbourhood, Bolzano-Weierstrass theorem, Heine-Borel theorem, Compactness, connectedness, Cantor's ternary set.

UNIT - II

Definition and example of a metric space, Diameter of a set, Bounded set, Open sphere, Interior point and Interior of a set, Derived and Closure of set, Closed set, Closed Sphere, Properties of Open and Closed sets, Boundary point of set. Convergent and Cauchy sequences, Complete metric space, Cantor's Intersection theorem. Dense subset, Baire Catagory theorem.

UNIT - III

Limit of a function, Continuous function, Theorem on necessary and sufficient conditions for continuity of a function, Uniform continuity, Contracting mapping, Banach Fixed Point theorem, Equivalant matrices, Compactness, Sequentially compactness, Totally Bounded space, Finite Intersection properties.

UNIT - IV

Complex Numbers as ordered pairs, Complex plane, Geometrical representation, Connected and compact sets, Curves and region in the complex plane, Statement of Jordan curves theorem, Extended complex plane and stereographic projection, Complex valued functions limits, Convergence,continuity, Differentiailbility in the extended plane, Analytic functions.Cauchy- Reimann equations (Cartesian and Polar forms).

UNITV

Harmonic functions, Construction of an analytic function, Conformal mapping, Bilinear transformation and its properties, Fixed points, Cross ratio, Inverse point, Elementary maps., Z , sin Z and log Z

Suggested Readings

1. "Principle of Mathematical Analysis" by Walter Rudin
2. "Theory and Application of Infinite Series" by K Knopp
3. "Mathematical Analysis" by T M Apostol
4. "Foundations of Mathematical Analysis" by Richard Johnsonbaugh
5. "Introduction to Real Analysis" by Robert G Bartle and Donald R Sherbert
6. "Elements of Real Analysis" by Narayan Shanti and Raisinghania M D

PAPER III - OPTIMIZATION TECHNIQUES &

STATISTICS

Paper Code; 03ABM 109__   **Maximum   Marks: 100**

External Marks; 70__   **Internal Marks: 30**

UNIT -1

Formulation and Graphical solution of Linear Programming Problem, Linear independence, Linear dependence, Basis, Dimensions, Convex set and its properties. The theory of simplex method.

UNIT - II

The Simplex algorithm and its application to simple linear programming problem, Big-M method, Two phase method. Concepts of Duality in linear programming. Formation of dual problem

UNIT - III

Assignment problem, Transportation problems.

UNIT -1Y

Probability : Law of total and compound probability, Random variable, Expection, Moments, Moment generating functions.

UNIT - V

Binomial, Poission and Normal distribution.

Suggested Readings

1. https://doi.org/10.1016/C2009-0-21327-4
2. Optimization Techniques in Statistics A volume in Statistical Modeling and Decision Science Jagdish S. Rustagi
3. "Optimization: Theory and Practice" by G S G Beveridge and R S Schechter
4. "Introduction to Optimization Techniques" by M Aoki
5. "Optimization Techniques" by L R Foulds
6. "A Gentle Introduction to Optimization" by B Guenin and J Konemann

INDIAN GEOLOGY AND ECONOMIC GEOLOGY <u>Paper Code:</u>

<u>03ABM 110</u>   **Maximum Marks: 100**

<u>External Marks; 70</u>   **Internal Marks: 30**

A. INDIAN GEOLOGY

UNIT I

Brief study of the physiographic divisions of India. Major geological divisions ofIndia. Geological time scale and its representative in Indian stratigraphy. Generalstudy of Early Precambrian terrains of India and detailed study of the lithology,classification, structure, syn-and post-tectonic intrusives, organic remains, radiometricage and economic resources of the following: Archaean   Formations- Sargur Supergroup, Dharwar Supergroup and

associatedgranites and gneisses. Aravalli Supergroup of Rajasthan.Singhbhum Craton .SausarSeries. Sakoli.

UNIT II

General study of the Proterozoic formation .Precambrian terrains of India and detailedstudy of lithology, classification, structure, associated intrusives, organic remains,radiometric age and economic resources of the following:Delhi Supergroup, Cuddapah Supergroup, Vindhyan Supergroup and Kumol supergroup..

UNIT III

A brief study of the distribution of marine Palaeozoic and Mesozoic successions of India and detailed study of the following: Palaeozoic and Triassic succession of Spiti region. Jurassic of Spiti and Kutch. Cretaceous of Trichinopoly and Narmada Valley.

UNIT IV

Gondwana Supergroup: Distribution, lithology, classification, age, structural features, fossils and coal resources. Deccan Traps and associated sedimentaries, thier distribution, lithology, classification,fossils and age.

UNITV

A brief study of the distribution of Cenozoic rocks of India with detailed study of the following: Cenozoic oil-bearing formations, Siwalik Supergroup, Tertiaries of Tamilnadu . Karewas, Indo- Gangetic Alluvium.

UNIT VI.

Geology of Kerala - Precambrian and Tertiaries

B. ECONOMIC GEOLOGY

UNIT VII

Definition and scope of economic geology - Ore and gangue minerals, tenor of ores - syngenetic and epigenetic deposits- Classification of mineral deposits - Bateman's calssification and modem trend in classification.

UNIT VIII

Magmatic deposits-Hydrothermal deposits .Pegmatite mineral deposits, volcanic exhalative deposits-Contact metasomatic deposits-.

UNIT VIII

Evaporites, sedimentary deposits, oxidation and supergene sulphide enrichment deposit, mechanical concentration deposits, residual concentration deposits. Metamorphic deposits

UNIT IX

Mode of occurrence, distribution in India and important economic uses of the following: Ores of aluminium, chromium, copper, gold, iron, lead, zinc, manganese, thorium, uranium and titanium Minerals used as abrasives, refractories, Fertilizers, ceramics and gem stones, coal and petroleum. Mineral deposits of Kerala

Suggested Readings

1. "Economic Geology: Economic Mineral Deposits" by U Prasad
2. "Ore Geology, Economic Minerals and Mineral Economics" by S K Tiwari
3. "An Introduction to Geology: With Multiple Choice Questions" by V S Joji
4. "Economic Geology Principles And Practice" by Pohl W L
5. "Economic Geology; Or, Geology In Its Relations To The Arts And Manufactures" by David Page

PETROLOGY

Paper Code: 03ABM 111   **Maximum Marks: 100**

External Marks; 70   **Internal Marks: 30**

A. IGNEOUS ROCKS

UNIT I

Rocks and their classification. Igneous rocks. Primary and secondary rocks Rock cycle .Magma and its composition . Evolution of magma. Crystallisation of magma. Reaction principle and Bowen's reaction series.

UNIT II

Crystallisation of the following binary systems:

1. Albite-Anorthite

2. Forsterite-Fayalite

3 .Diopside-Anorthite

4.Forsterite - Silica.

UNIT III

Textures and structures of igneous rocks. Classification and nomenclature of igneous rocks. Forms of igneous rocks .

UNIT IV

Systematic description and petrogenesis of the following families: granite, syenite, diorite and gabbro.Holomafics.

B .SEDIMENTARY ROCKS

UNITV

Origin, transportation and deposition of sediments, stucture and texture of sedimentary rocks.

UNIT VI

Description , origin and classification of sedimentary rocks . Residual rocks , pyroclastic rocks, detrital rocks , chemical rocks and organic rocks.

Brief study of the following: Carbonaceous rocks and laterites.

C.   METAMORPHIC ROCKS.

UNIT VIII

Definition of metamorphism, factors of metamorphism, types of metamorphism. Metasomatism, Prograde and retrograde metamorphism,

UNIT IX

Nomenclature of metamorphic rocks, zones of metamorphism and index minerals , concept of metamorphic facies and grades.

UNIT X

Metamorphism of argillaceous , arenaceous ,calcarious and basic rocks. Description of Slate , phyllite , schist, gneiss , amphibolite , marble, granulite.

Suggested Readings

1. "Principles of Petrology" by Tyrrell
2. "Principles of Igneous and Metamorphic" by Winter
3. "Petrology, Igneous, Sedimentary, Metamorphic" by Ehlers
4. "Petrology of the Igneous Rocks" by Hatch F H
5. "Principles of Igneous and Metamorphic Petrology" by Philpotts And Ague
6. "Igneous and Metamorphic Petrology" by Turner